DGE AND BUILDING
NVENTION NUMBER

NOVEMBER, 1948

Railway Engineering and Maintenance

2 Simple Steps -

completely protect Joint Bars AGAINST CORROSION

NO-OX-ID "A SPECIAL"

For protection of rail joints against corrosion and to provide lubrication at the fishing area.

NO-OX-ID JOINT BAR FILLER

A new mastic formulation of No-Ox-Id used as a stopper or plug to close the ends of joint bars.

STEP #1

No-Ox-Id "A Special" for protection against corrosion and lubrication of rail joints. This well-known and established product fulfills the double duty of the job condition. Tables are available, on request, showing amounts of material required for a mile of track with various rail weights.

The cost of No-Ox-Id for this use, compared to your present material, may be a relatively minor added cost. By comparison with the outlay for a mile of track, the cost of the best joint protection is nominal.

STEP #2

No-Ox-Id Joint Bar Filler completes the protection by sealing out rushing air laden with brine, grit, and dirt.

Joint Bar Filler is a No-Ox-Id formulation to serve as a plug or stopper at the ends of the joint bars, and prolong the service life of the lubricating qualities of No-Ox-Id over the fishing area.

While it has been in use on test sections of main line track for over a year, it is being announced now for the first time. It is easy to apply with paddle or putty knife after the joint is permanently assembled.

NO-OX-ID
IRON RUST
REG. TRADEMARK
AUG. 27, 1918

THE *Original* RUST PREVENTIVE

Dearborn Chemical Company
Dept. U, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago 3, Ill. Subscription price: United States and Possessions, and Canada, $2.00 for one year; $3.00 for two years. Single copies 50 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., post office. Address communications to 105 W. Adams St., Chicago 3, Ill.

THIS DEVICE

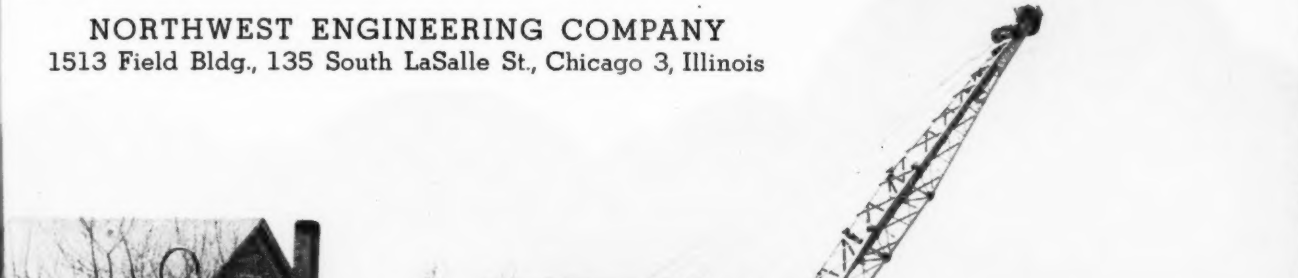
means greater safety in shovel and crane operation!

It is simple — a band device that provides ease of operation for your Northwest Shovels, Cranes and Draglines without the complicatons of high pressure pumps, valves and lines. There is nothing to refill. It is unaffected by weather or temperature and it has been proved in years of service.

Release is positive and the *feel of the load* is in direct ratio to the movement of the control lever. It is known as the "Feather-Touch" Clutch Control and it means greater output, accuracy of spotting in handling loads and greater safety with a certainty that there will be *no shutdown because of control failure.*

This is only one of the many advantages of Northwest equipment. Let us tell you how you can plan ahead for a Northwest for your division. Ask for details on the size machine you need.

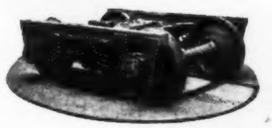
NORTHWEST ENGINEERING COMPANY
1513 Field Bldg., 135 South LaSalle St., Chicago 3, Illinois

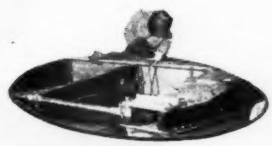


NORTHWEST

THE ALL PURPOSE RAILROAD MACHINE
SHOVEL • CRANE • DRAGLINE • PULLSHOVEL

 For additional information, use postcard, pages 1127-1128

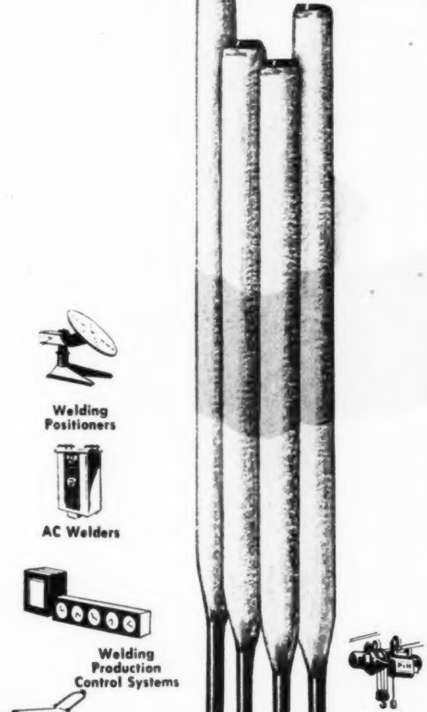




speed up your Maintenance Program

Reduce Your Fabricating and Repair Costs

...use efficient P&H electrodes for fast deposition, sound welds, and easy manipulation



There's a time-saving P&H electrode for every welding problem — Steel sheet, some bar stock and channels provide a quick, easy method of giving your old cars the "new look." For work of this kind we recommend two electrodes — the Class E-6010 "AP" rod and the Class E-6012 "PF" rod. These two electrodes can do 90% of all your welding:

"AP" *is one of the most versatile of all electrodes* and is applicable to almost every railroad use. Designed for all-position work, it produces welds of X-ray quality, and is especially suitable for use on structural steel, where tied-up stresses are involved.

"PF" *solidifies rapidly and makes easy work of welding irregular and poor-fit-up joints.* You find also that this electrode does extremely fine work on sheet metal, and should be used on mild steel whenever you desire high tensile strength.

For *building up and hard surfacing worn parts,* your best bet is one of the new P&H Hartop electrodes.

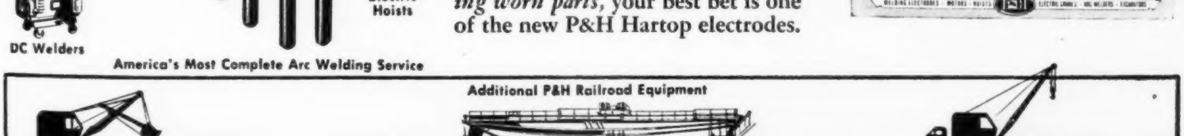
Nicast, thanks to its proper coefficient of expansion, is ideal for making machinable repair welds in cast iron, or for joining cast iron to steel.

It pays to use P&H electrodes. Investigate all their money-saving advantages. Consult a P&H railroad representative or write to us.

P&H

RAILROAD SALES DIVISION
4420 W. National Ave.
Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION



 For additional information, use postcard, pages 1127-1128

 For additional information, use postcard, pages 1127-1128

Is your plant an easy target for corrosion?

KOPPERS COATINGS can protect it!

EVERY year, rust and corrosion exact a terrific toll from industry . . . billions of dollars in fact. But you can easily cut your plant's contribution—and it *is* a contribution—by using Koppers Industrial Protective Coatings.

For example, here's how Koppers Bituplastic* protects metal, concrete or masonry: Bituplastic (it's not a paint) coats exposed surfaces with a tough film. This protective film is thick; three coatings of Bituplastic build up a seamless, non-porous sheath nearly 1/16" in thickness—a sheath that not only resists water, but the assaults of sun, salt air, condensation, atmosphere, weather, and acid or alkaline fumes.

Read the list of other advantages offered by Bituplastic. And for complete data, including suggestions for use and rate of coverage, send for our new Bulletin on Bituplastic.

8 Other Advantages of Bituplastic...

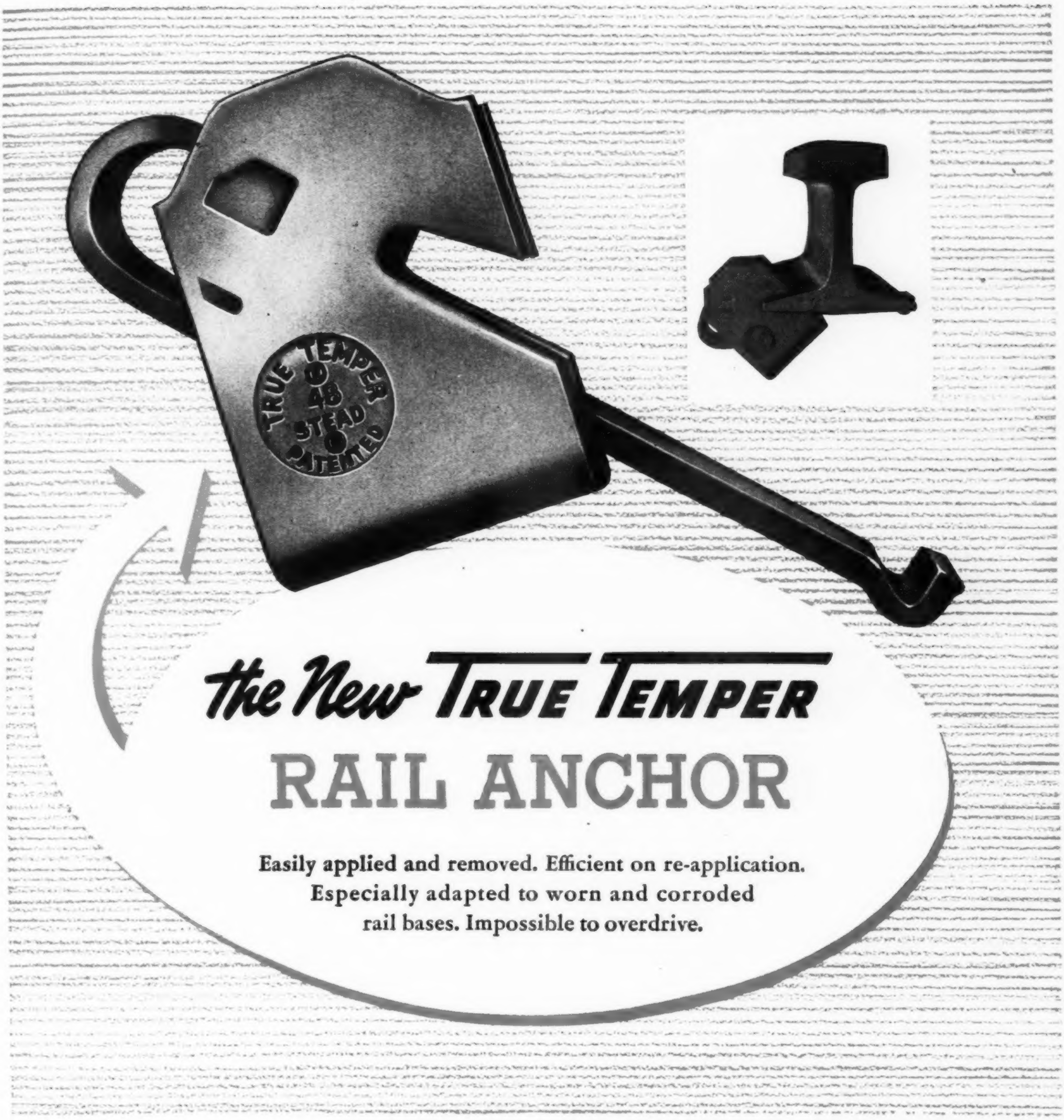
1. *It is a highly-refined, easily-workable coal-tar pitch coating.*
2. *It covers heavily; 1/64" to a coat, or about 5 times the thickness of ordinary paint.*
3. *It does not "alligator" or check.*
4. *It is applied cold with brush or spray.*
5. *It is fire retardant.*
6. *It does not crack at minus 50°F. or sag at 500°F.*
7. *It is practically odorless and tasteless.*
8. *It dries quickly.*

*Trade-Mark Reg. U. S. Pat. Off.

KOPPERS

KOPPERS COMPANY, INC., Dept. 1108T, Pittsburgh 19, Pa.

IMPORTANT! *Plant engineers and maintenance men agree that* specialized *protective coatings are needed to control corrosion. Remember that Koppers makes 6 Protective Coatings, all specifically formulated to protect under severe conditions.*



 For additional information, use postcard, pages 1127-1128

Here's the high-speed, rubber-tired

Self-loading

7 Cu. Yd. (9 TON) *capacity*

Speeds to 25 m.p.h.

Tournapull, Carryall—Trademark Reg. U.S. Pat. Off.

Send for complete Facts

To: R. G. LeTOURNEAU, Inc., PEORIA, ILL. Please send information on "D" ROADSTER:

☐ Specifications ☐ Price ☐ Delivery ☐ Would like job analysis on present operations

NAME...TITLE.................................

COMPANY...TYPE OF WORK.........................

STREET...CITY, STATE..........................

Would also like information on ☐ 13.3-yard "C" TOURNAPULL ☐ Big 30-yard "B" TOURNAPULL

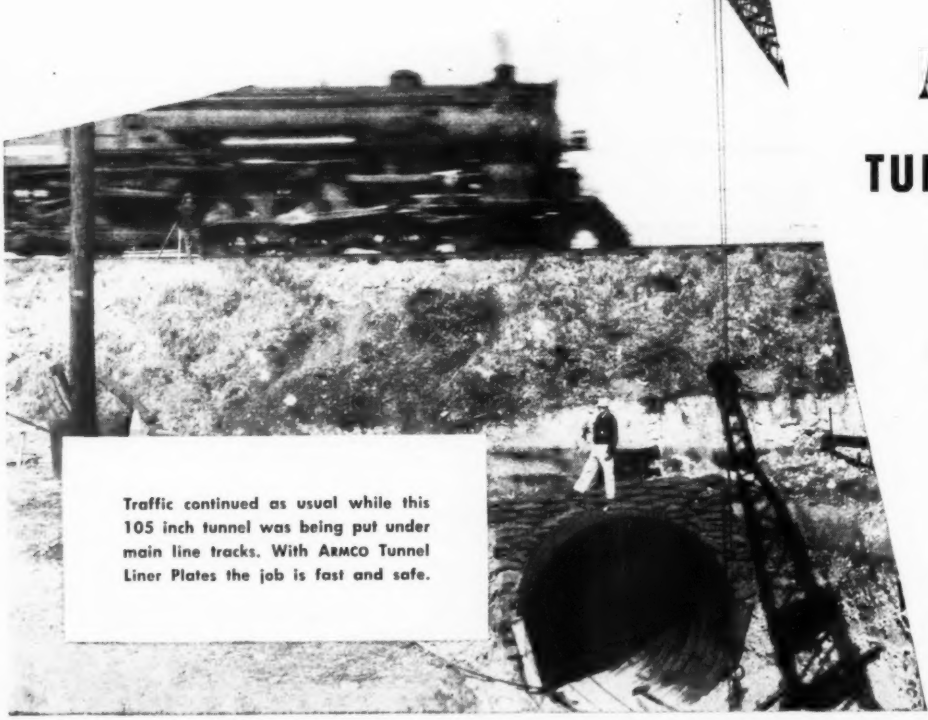
hole through . . . ahead of schedule

Have you heard about ARMCO Tunnel Liner Plates for faster, more economical tunneling? Here's the simplest, most inexpensive way you ever saw to line new tunnels or reline old ones.

These sturdy, corrugated liner plates are designed to assure safe strength without excessive bulk or weight. One man can easily handle the light-weight steel sections, bolting them together with ordinary wrenches. The job moves fast.

With ARMCO Liner Plates you gain added safety, fire-protection, and utmost economy. No paying "hidden costs" in excess weight. And ARMCO Tunnel Liner Plates are nestable to conserve hauling and storage space.

Consider ARMCO Liner Plates for that next tunneling job. The chances are you'll "hole through" ahead of schedule and under the estimate. Diameters range from 45¼" to 33 feet. Write for complete data. Armco Drainage & Metal Products, Inc., 1275 Curtis Street, Middletown, Ohio.



Traffic continued as usual while this 105 inch tunnel was being put under main line tracks. With ARMCO Tunnel Liner Plates the job is fast and safe.

ARMCO
TUNNEL LINER PLATES

ARMCO

For additional information, use postcard, pages 1127-1128

Safeguard Rail Travel with
PITTSBURGH SNOLITE

. . . for crossing gates, signs, fences, and cattleguards

FASTER schedules require that all types of signs and signals be maintained at higher standards for safer operation at higher speeds.

Pittsburgh provides special finishes for this purpose that last longer and provide higher visibility. SNOLITE is a durable coating for crossing gates, signs, fences and cattleguards.

SNOLITE dries to a smooth surface of superior whiteness which eventually chalks instead of checking or cracking. Even after chalking, SNOLITE continues to hide the surface with uniform color. Industrial gases and smoke fumes will not discolor it.

Pittsburgh also provides special IRONHIDE Signal Enamels with color-fast pigment and synthetic resins for higher gloss and color retention.

Write today for Pittsburgh's new booklet of Railway Structural Finishes. It may help to save you time and money.

PITTSBURGH PLATE GLASS COMPANY
Industrial Paint Division, Pittsburgh, Pa.
Factories: Milwaukee, Wis.; Newark, N. J.; Springdale, Pa.; Houston, Texas; Los Angeles, Calif.; Portland, Ore. Ditzler Color Division, Detroit, Mich. The Thresher Paint & Varnish Company, Dayton, Ohio. Forbes Finishes Division, Cleveland, Ohio.

PITTSBURGH PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

FOR THE OVER-ALL JOB OF TRACK MAINTENANCE

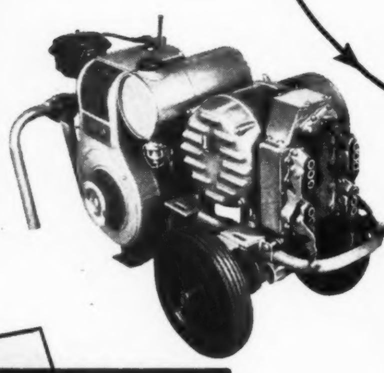
★ ★ ★ ★ THE **JACKSON**

4-TAMPER OUTFIT

IDEAL FOR THE SECTION GANG

tops the field!

Four Jackson Vibratory Tampers with the Jackson Model M-2 Power Plant constitute the most universally adaptable and advantageous outfit imaginable. For, it is ideal not only for spotting, skeletonizing and such out-of-face surfacing work as is usually done by the average section gang, but equally efficient in extra-gang service. Consequently when section gangs are thus equipped, a number of these outfits may be grouped to great advantage for major new ballast insertions or making a general lift; and when the big job is completed, again returned to the sections. The Jackson 4-tamper outfit is the outstanding favorite of track maintenance men throughout the country. Let us tell you more about it.



PERFECT FOR EXTRA GANG SERVICE

ELECTRIC TAMPER & EQUIPMENT CO.

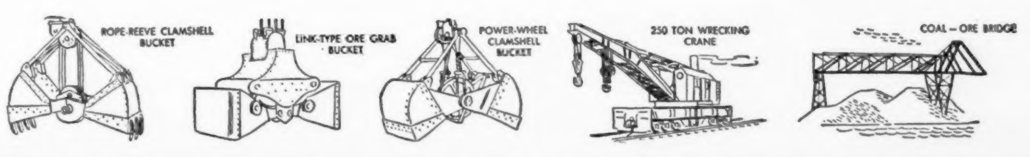
Ludington, Mich.

You can take them from the sections — group them to great advantage for extra gang service — return them to the sections when the big job is finished.

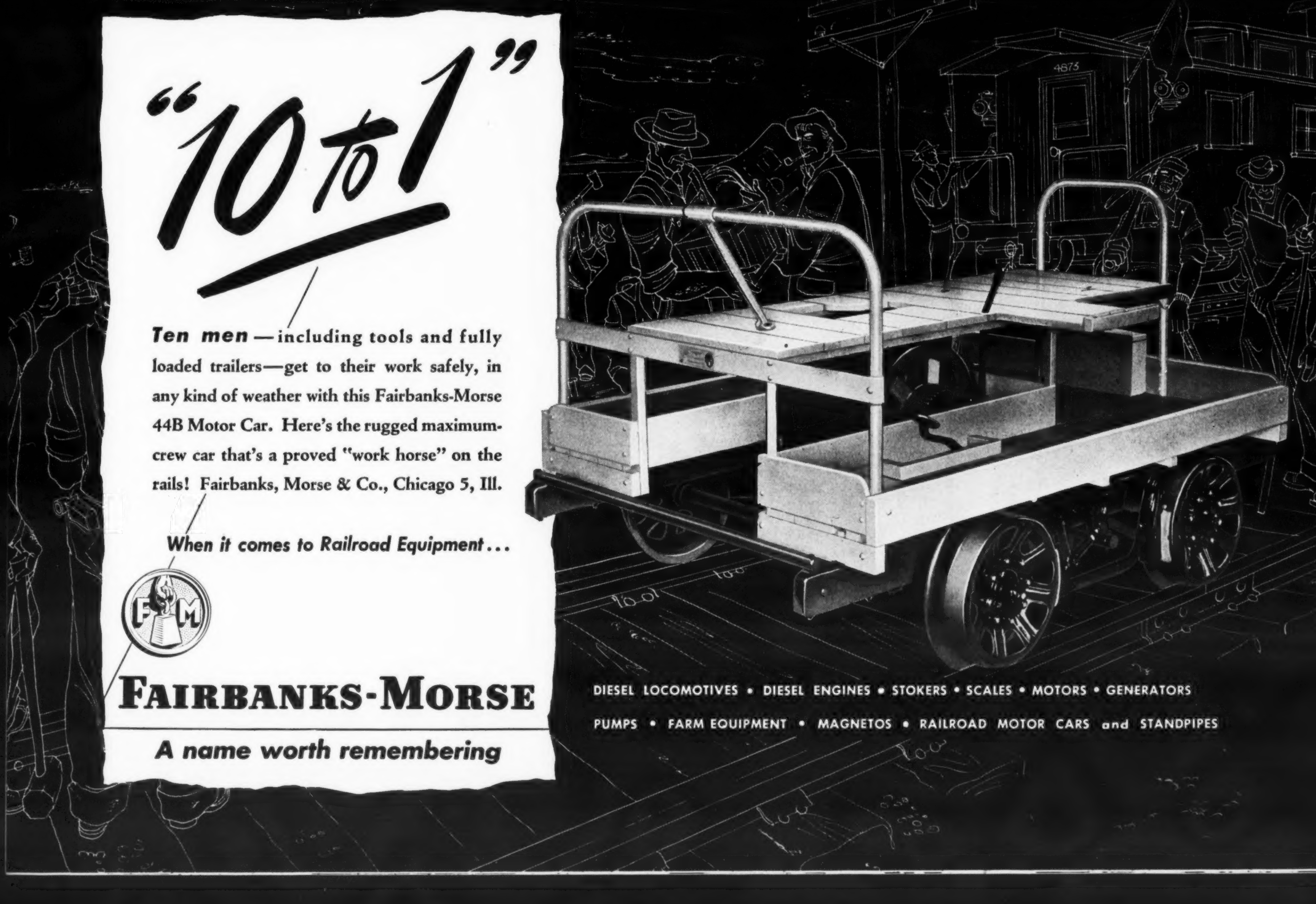
"YOU CAN TELL BY THE CAB IT'S AN *Industrial Brownhoist*"

Men who know cranes can always spot an Industrial Brownhoist by its exclusive, patented Monitor-type cab. The operator is centrally located in relation to the load and is stationed above and behind the machinery. It provides the operator with 360° visibility—*front, rear and both sides*—plus a full view of hoist and boom drums, machinery and load at all times. Two doors, one on each side of the cab, *contribute to greater safety* and with the windows afford maximum ventilation. The result is *easier, faster, safer materials handling.* Write today for illustrated literature giving complete facts.

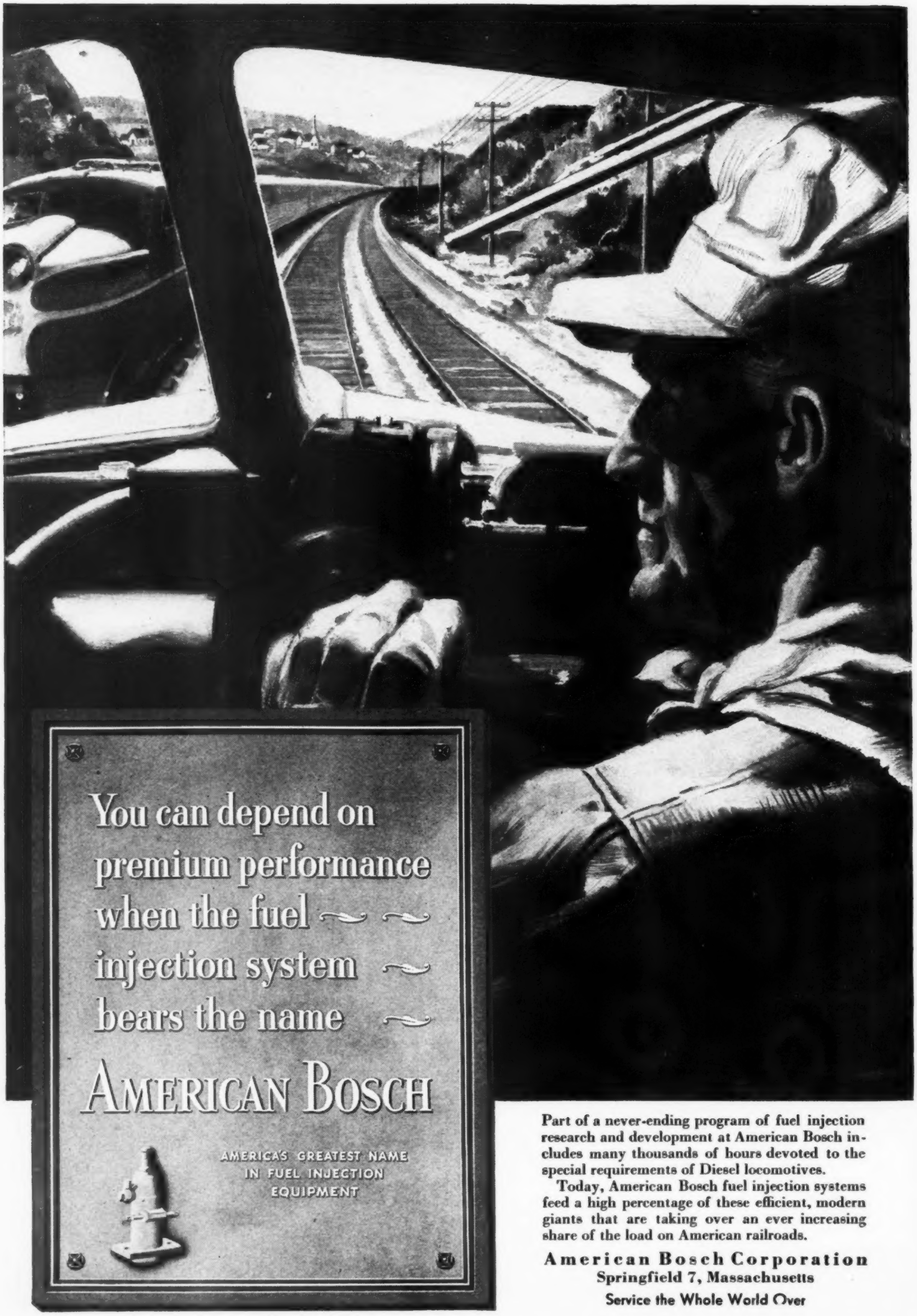
BROWNHOIST BUILDS BETTER CRANES



INDUSTRIAL BROWNHOIST CORPORATION • BAY CITY, MICH. • **DISTRICT OFFICES:** NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO • **AGENCIES:** DETROIT, BIRMINGHAM, HOUSTON, LOS ANGELES, PORTLAND, SAN FRANCISCO, SEATTLE, SPOKANE, CANADIAN BROWNHOIST LTD., MONTREAL, QUEBEC.


"10 to 1"
Ten men — including tools and fully loaded trailers—get to their work safely, in any kind of weather with this Fairbanks-Morse 44B Motor Car. Here's the rugged maximum-crew car that's a proved "work horse" on the rails! Fairbanks, Morse & Co., Chicago 5, Ill.
When it comes to Railroad Equipment...
FAIRBANKS-MORSE
A name worth remembering
DIESEL LOCOMOTIVES • DIESEL ENGINES • STOKERS • SCALES • MOTORS • GENERATORS
PUMPS • FARM EQUIPMENT • MAGNETOS • RAILROAD MOTOR CARS and STANDPIPES
4873


"Since the cost per unit of most building materials installed today is more than twice what it was before the war, building must be more permanent, so that maintenance costs will be reduced to the absolute minimum."
P. O. Ferris, Chief Engineer
Delaware and Hudson Railroad
Build for Permanence
—with—
Koppers
Pressure-Creosoted
Wood
A comparable masonry structure would cost far more than this Koppers PRESSURE-CREOSOTED Timber Bridge. And Koppers Pressure Creosoting gives timbers high resistance to the weakening influences of wear and weather. Bridges pressure-treated like this one have given satisfactory service for over 40 years . . . and they are still good for many additional years of usefulness.
Build long life at low cost into your bridges, overpasses, crossings, pile foundations, pole lines, platforms and other installations with Koppers PRESSURE-CREOSOTED Wood. Long life and low maintenance will boost your margin of profit.



Part of a never-ending program of fuel injection research and development at American Bosch includes many thousands of hours devoted to the special requirements of Diesel locomotives.

Today, American Bosch fuel injection systems feed a high percentage of these efficient, modern giants that are taking over an ever increasing share of the load on American railroads.

American Bosch Corporation
Springfield 7, Massachusetts
Service the Whole World Over

THE **American** DIESELECTRIC

A Revolutionary New Locomotive Crane

Once upon a time, the coal scoop was a mighty important tool on locomotive cranes. But new and better power sent the scoop to the scrap heap.

Today, with the AMERICAN DIESELECTRIC on the scene, many other outworn features are disappearing forever. For example, the cluttered, awkward machinery deck—where even the simple job of greasing can be unbelievably expensive—has now been magically transformed.

Summed up, the many advanced new features of the DIESELECTRIC mean just this: Tremendously increased production . . . astonishing cash savings on maintenance work . . . faster operating speeds . . . less operator fatigue . . . *more tons moved at lower cost.*

American Hoist
and DERRICK COMPANY
St. Paul 1, Minnesota
Plant No. 2: So. KEARNY, N.J. • *Sales Offices:* NEW YORK
CHICAGO • PITTSBURGH • NEW ORLEANS • SAN FRANCISCO

•

DIESEL
power to the deck;
ELECTRIC
power to the trucks

•

SEVEN TONS
of wearing parts eliminated

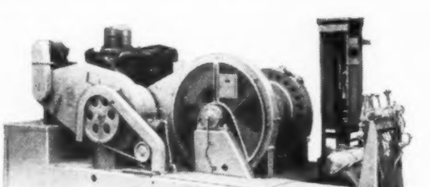
•

CUTS UPKEEP
25% to 50%

•

PAYS FOR ITSELF
in five years!

NEW Deck Design
MAKES SERVICE WORK EASY!



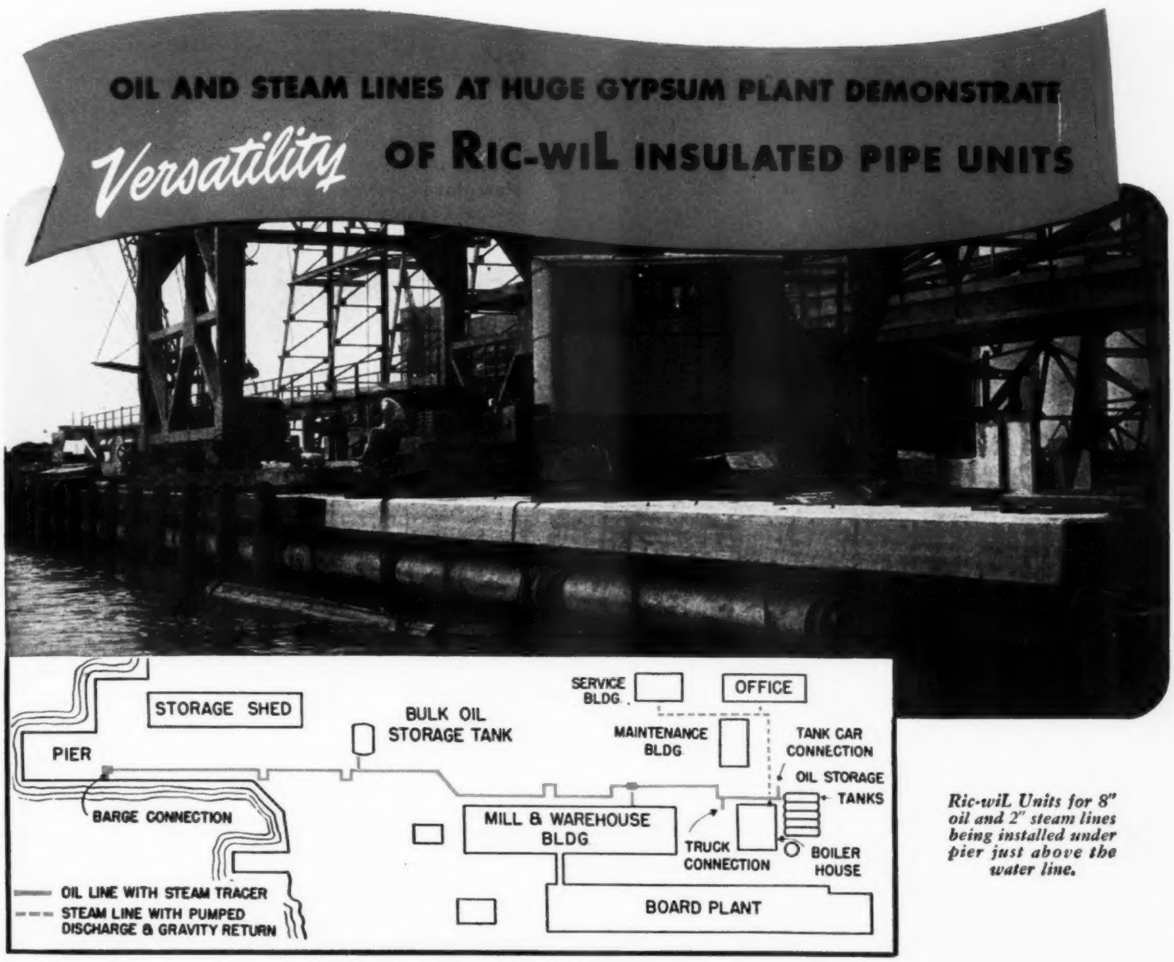
● It's what you don't see in this picture of the DIESELECTRIC machinery deck that's important. First, all travel machinery is gone—because the electric traction system is all in the underbody. There's no pyramiding of machinery. Tail swing has been shortened by two feet. Walkways are clear, open, safe. All units needing repair or lubrication are instantly accessible. Result: lowest maintenance costs in locomotive crane history!

AMERICAN HOIST
and DERRICK COMPANY 8605
St. Paul 1, Minnesota

Please send your Catalog No. 600-L-4, describing the AMERICAN DIESELECTRIC Locomotive Crane.

Name____________________
Company____________________
Address____________________
City____________ State________

 For additional information, use postcard, pages 1127-1128



Ric-wiL Units for 8" oil and 2" steam lines being installed under pier just above the water line.

AT THE GREAT NEW PLANT of the National Gypsum Company at Baltimore Ric-wiL Insulated Piping was specified for lines carrying fuel oil from ship to storage tanks, boiler house and mill, and steam from boiler house to various plant structures. These oil and steam lines are typical examples of the adaptability of Ric-wiL Pipe Units to diversified uses and conditions, and the efficiency with which they will accommodate any required arrangement or combination of pipes.

The oil line shown in the diagram with its various branches comprises more than 1600 ft. of Ric-wiL Units with pipes insulated from the exterior but not from each other. Capable of carrying 800 gallons of oil per minute at 150°F., the line runs just above the water line under the pier, and continues underground as indicated. Welded connections are used throughout.

These Ric-wiL arteries of fluid transportation consist of an 18" conduit enclosing an 8" oil line with 2" steam tracer from Boiler House to Pier along with 3" and 1¼" oil lines from Boiler House to Mill. Proper oversizing of conduit provides for expansion and lateral movements. Other combinations of Ric-wiL Units convey steam, with condensate return to various service outlets.

Specified also for these installations were completely prefabricated Ric-wiL accessory units and fittings, including expansion loops, ells, anchors, conduit decreasers, watersheds, tees and glands.

Scientific design and construction of Ric-wiL Insulated Pipe Units, precision prefabricated to exact conformity with specifications, assure high thermal efficiency, dependability and minimum maintenance requirements for these systems.

Consulting Engineers: Hall, Turpin and Wachter, Baltimore
General Contractor: Baltimore Contractors, Baltimore

For more complete information on Ric-wil systems write: The Ric-wiL Co., Dept. 13-A

RIC-WIL
INSULATED PIPING SYSTEMS
THE RIC-WIL COMPANY • CLEVELAND, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

Ingersoll-Rand

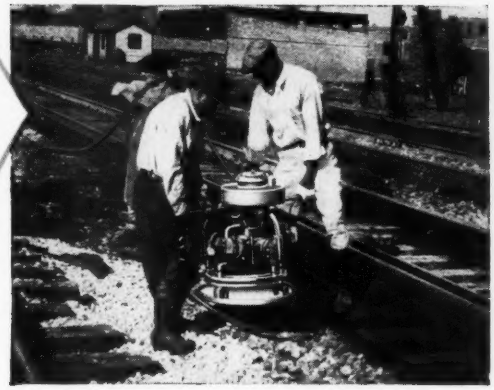
SPOT-AIR

New

SECTION-GANG COMPRESSOR

LIGHT enough to carry!

The Ingersoll-Rand SPOT-AIR is the lightest and most compact section-gang compressor yet developed. This gasoline-powered unit can be carried easily by two men. And one man can transport both the SPOT-AIR and Air Tools with the specially designed wheel-barrow type mounting which is available. This means less wasted effort... more work done.



The SPOT-AIR needs very little room in storage or on a section car, and is ideal for center-ditch operation under traffic. It is completely air cooled and is unique in its arrangement of engine and compressor cylinders about a single crank.

BIG enough for the job!

The SPOT-AIR has ample capacity to run two I-R tie-tampers...and you'll find it ideal for operating paving breakers, drills, impact wrenches, and many other I-R Air Tools.

Put the Ingersoll-Rand SPOT-AIR on your track work, bridge and building, grade-crossing and signal maintenance or emergency jobs. You will get better, faster work at lower cost.

IR

AIR TOOLS • COMPRESSORS • ROCK DRILLS • CENTRIFUGAL PUMPS • TURBO BLOWERS OIL AND GAS ENGINES • CONDENSERS

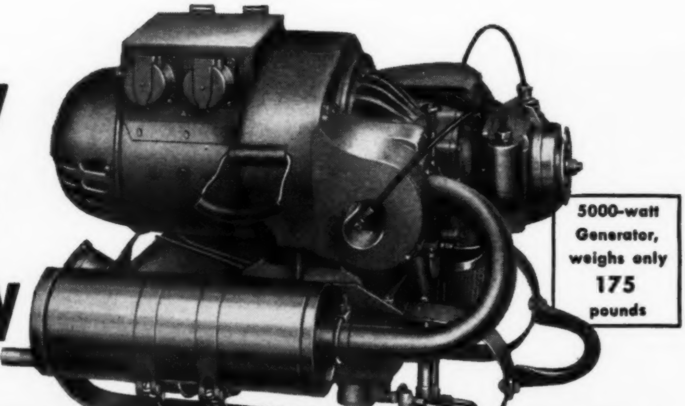
Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

221-11

For additional information, use postcard, pages 1127-1128

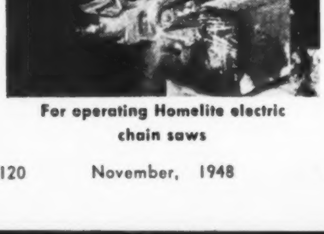
Night and Day Railroads are Saving Money



with HOMELITE Carryable GENERATORS


For operating high-cycle grinders


For operating high-cycle wrenches


For operating Homelite electric chain saws

Just figure it out for yourself. With the power furnished by one of the new Homelite Gasoline-Engine-Driven Dual Purpose Generators, a crew can operate the newest high cycle power tools as well as the standard universal tools and, in night emergencies, work under the advantages of brilliant floodlighting.

Yes, and what is more important, with Homelite *Carryable* Generators . . . easily transported everywhere . . . crews can always have the electric power they need any place they go.

This is the power age. And Homelite Generators are furnishing the power railroads need to operate modern, efficient tools that are reducing cost-consuming man-hours.

Write today for a free on-the-job Homelite demonstration. See how you too can save money and speed work with Homelite Carryable Generators.

HOMELITE CORPORATION

211 RIVERDALE AVENUE, PORT CHESTER, NEW YORK

Manufacturers of Homelite Carryable Generators • Pumps • Blowers • Chain Saws

 For additional information, use postcard, pages 1127-1128

For additional information, use postcard, pages 1127-1128

THE
BROWNING
LINE TODAY

BROWNING approaches its fiftieth year of crane and shovel manufacturing. Through many years of service Browning products have earned a reputation for rugged durability and reliability. A number of Brownings built in 1905 are still in daily operation. Here are the *modern* Browning machines—backed by *proven design* and a half-century of experience.

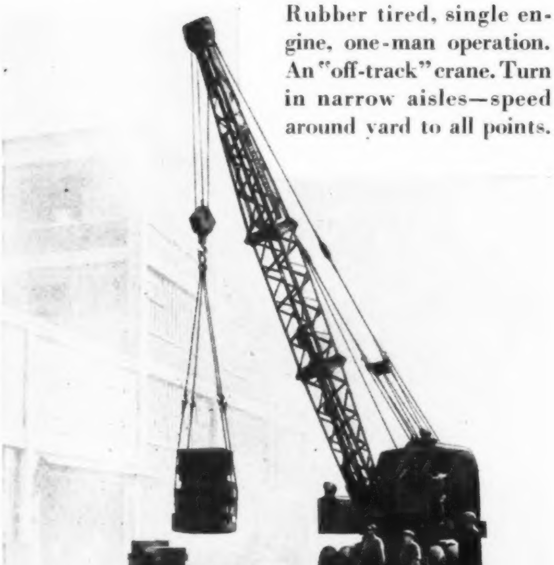
THE BROWNING CRANE & SHOVEL CO.
16224 Waterloo Road • Cleveland 10, Ohio

DIESEL LOCOMOTIVE CRANES

New fast-handling M-Series crane . . . one hand control of both drums . . . finger-tip operation. Stock pile the *heavy* material . . . "move it on the hook". Built for spotting cars . . . your switching locomotive.

SELF-PROPELLED WAGON CRANES

Rubber tired, single engine, one-man operation. An "off-track" crane. Turn in narrow aisles—speed around yard to all points.



TRUCK CRANES

Fast travel over the highway for jobs at distant points. Powerful where going is tough. 12 forward speeds. Construction, maintenance, pick-up work . . . your crane for all jobs.

BROWNING LOCOMOTIVE, WAGON TRUCK and TU-CONTROL *Cranes*

 For additional information, use postcard, pages 1127-1128

ADDITIONAL INFORMATION

On Any of the Products Mentioned in This Issue

Below is a complete index of the products referred to in both the editorial and advertising pages of this issue. If you desire additional information on any of them, use one of the accompanying addressed and stamped postcards in requesting it. In each case give name of product and page number. The information will come to you directly from the manufacturer involved, without any obligation on your part.

Products Index

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 32418, Sec. 510, P.L.&R. Chicago, Ill.

Postage Will be Paid by Addressee

RAILWAY ENGINEERING & MAINTENANCE

30 CHURCH STREET

NEW YORK 7, NEW YORK

READER SERVICE DEPT.

RAILWAY ENGINEERING AND MAINTENANCE November, 1948

Please send me additional product information as requested below.

☐ Literature Only ☐ Desire to see Representative ☐ Price Data

Product and Page No. ....

Name ....

Title or Position ....

Company ....

Address .... City .... Zone .... State ....

(Please Fill Out Card in Full)

RAILWAY ENGINEERING AND MAINTENANCE

November, 1948

Please send me additional products information as requested below.

☐ Literature Only ☐ Desire to see Representative ☐ Price Data

Product and Page No. ....

" ....

" ....

" ....

Name ....

Title or Position ....

Company ....

Address .... City .... Zone .... State ....

(Please Fill Out Card in Full)

Postage Will be Paid by Addressee

BUSINESS REPLY CARD

First Class Permit No. 32418, Sec. 510, P.L.&R. Chicago, Ill.

No Postage Stamp Necessary If Mailed in the United States

RAILWAY ENGINEERING & MAINTENANCE

30 CHURCH STREET

NEW YORK 7, NEW YORK

READER SERVICE DEPT.

BRIDGE FIRES!

This shows the first step in the Libbey-Zone Process—applying ZONE Heavy-Duty Coating to the ties and other wooden deck members.

The next step—applying the fine gravel aggregate to the horizontal surfaces of the structure immediately after applying ZONE Heavy-Duty Coating.

A close-up shot showing the method of applying the fine gravel to the horizontal surfaces. No skilled labor is required for any step in the process.

Applying the gravel to the vertical surfaces. At this point in the process the ZONE Heavy-Duty Coating is still soft and the gravel adheres easily. Progress is rapid.

The job completed. The entire process required only 36 hours and only 6 men were needed to handle the work. Past experience proves that this bridge is now almost completely resistant to fire resulting from fusees, brake slivers and such miscellaneous sources as careless smokers.

Division of Southwestern Petroleum Co.

Box 789, Fort Worth 1, Texas

Switch Stand

for more efficient switching

Modern design assures quick, simple operation of yard and main line switches

● Here is a switch stand consistent in design and quality with present day trackwork standards.

Conforming to A.R.E.A. specifications for ground throw switch stands, the U·S·S No. 140 switch stand provides dependable service for either main line or yard use.

Its large bearings reduce wear to a minimum and prevent wobble of targets and lamps. The hand lever socket and pinion are integral with the connecting shaft, keeping the lever and pinion firm at all times on the bearing shaft.

The U·S·S No. 140 stand can be furnished in a variety of assemblies, so that you may specify the arrangement which best fits your needs. Red and white targets are standard, but any color or pattern can be supplied.

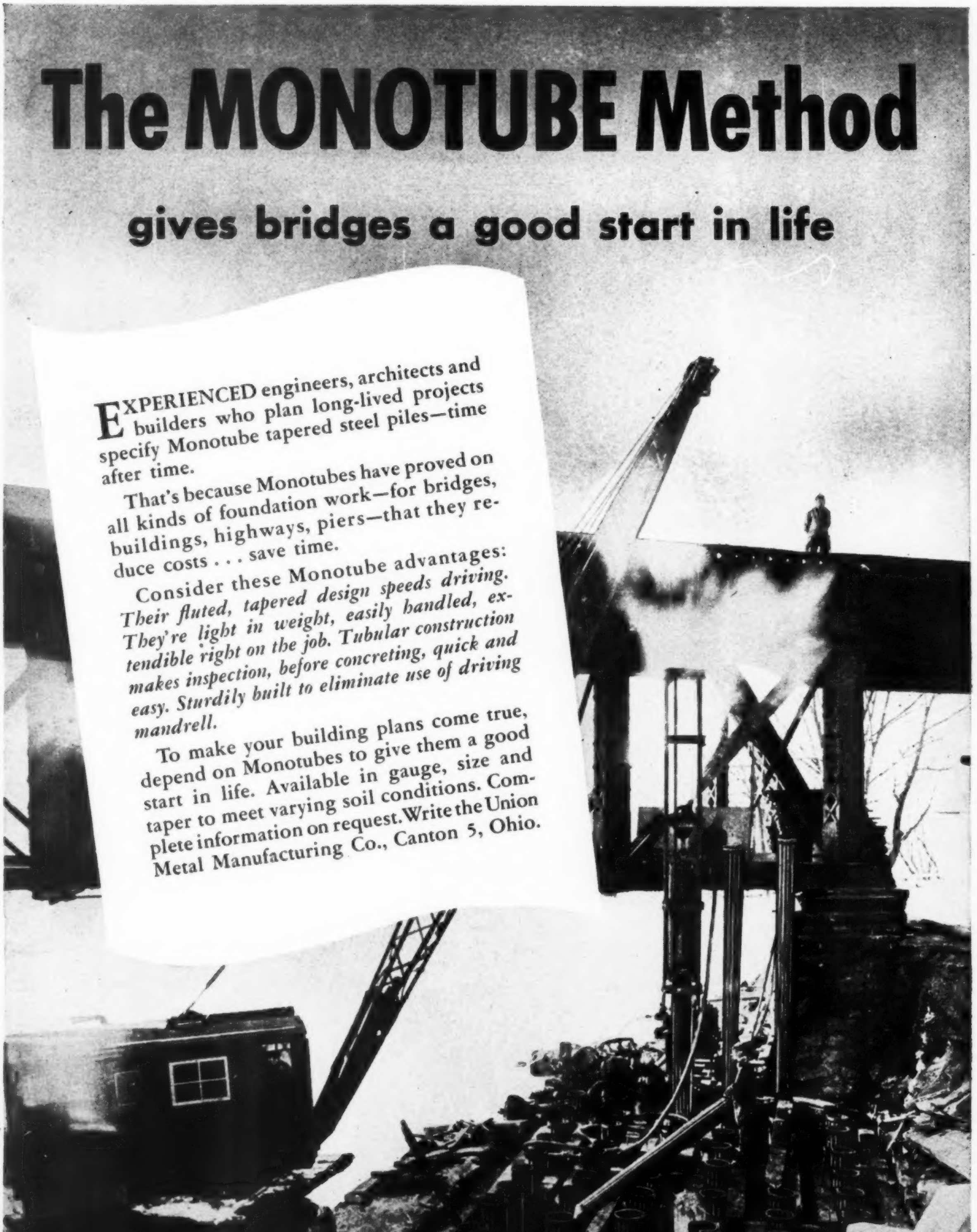
For additional information, write to Carnegie-Illinois Steel Corporation, Pittsburgh 30, Pa.

USS

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

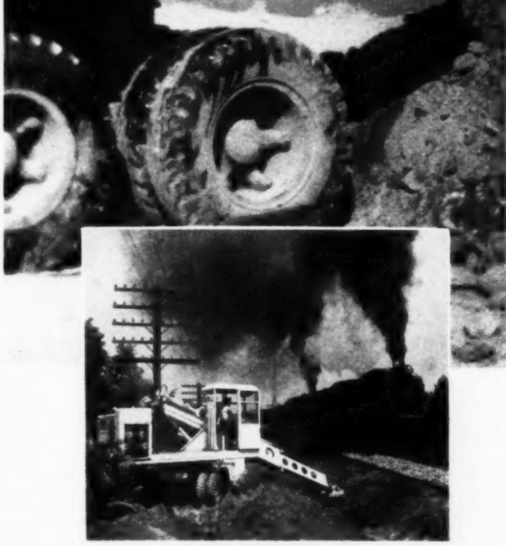
8-1386

UNITED STATES STEEL

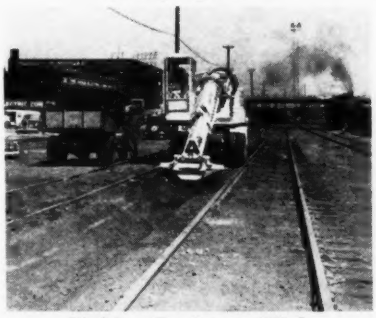

The MONOTUBE Method
gives bridges a good start in life
EXPERIENCED engineers, architects and builders who plan long-lived projects specify Monotube tapered steel piles—time after time.
That's because Monotubes have proved on all kinds of foundation work—for bridges, buildings, highways, piers—that they reduce costs . . . save time.
Consider these Monotube advantages: Their fluted, tapered design speeds driving. They're light in weight, easily handled, extendible right on the job. Tubular construction makes inspection, before concreting, quick and easy. Sturdily built to eliminate use of driving mandrell.
To make your building plans come true, depend on Monotubes to give them a good start in life. Available in gauge, size and taper to meet varying soil conditions. Complete information on request. Write the Union Metal Manufacturing Co., Canton 5, Ohio.
UNION METAL
Monotube Foundation Piles

GRÂDALL "arm-action"

MAKES UNUSUAL JOBS EASY!



Reshaping Ditch



Making Drainage Ditch
Between Tracks

SCOOPING solidly frozen earth from truck beds on the Mesabi Iron Range is one of the many jobs performed by the Gradall beyond the call of duty. This job ordinarily done manually was laborious and dangerous. It once took hours—now with Gradall it takes only minutes.

Railroad maintenance demands are for a machine which can meet the many and varied problems peculiar to this field. Right-of-way maintenance, ditching, culvert preparations can all be easily and efficiently handled with a Gradall. Its versatility and maneuverability offer almost limitless possibilities.

That Gradall is already a favorite of railway maintenance men, because of its multi-purpose adaptability, is evidenced by repeat orders. It travels from job to job with truck speed. With tools at end of telescoping boom, easily interchangeable in a few minutes, the Gradall does a score of railroad maintenance jobs, easier, better, and at lower cost.

Get all the facts about Gradall. Write Warner & Swasey, Cleveland 3, Ohio.

GRÂDALL
DIVISION
WARNER
&
SWASEY
Cleveland

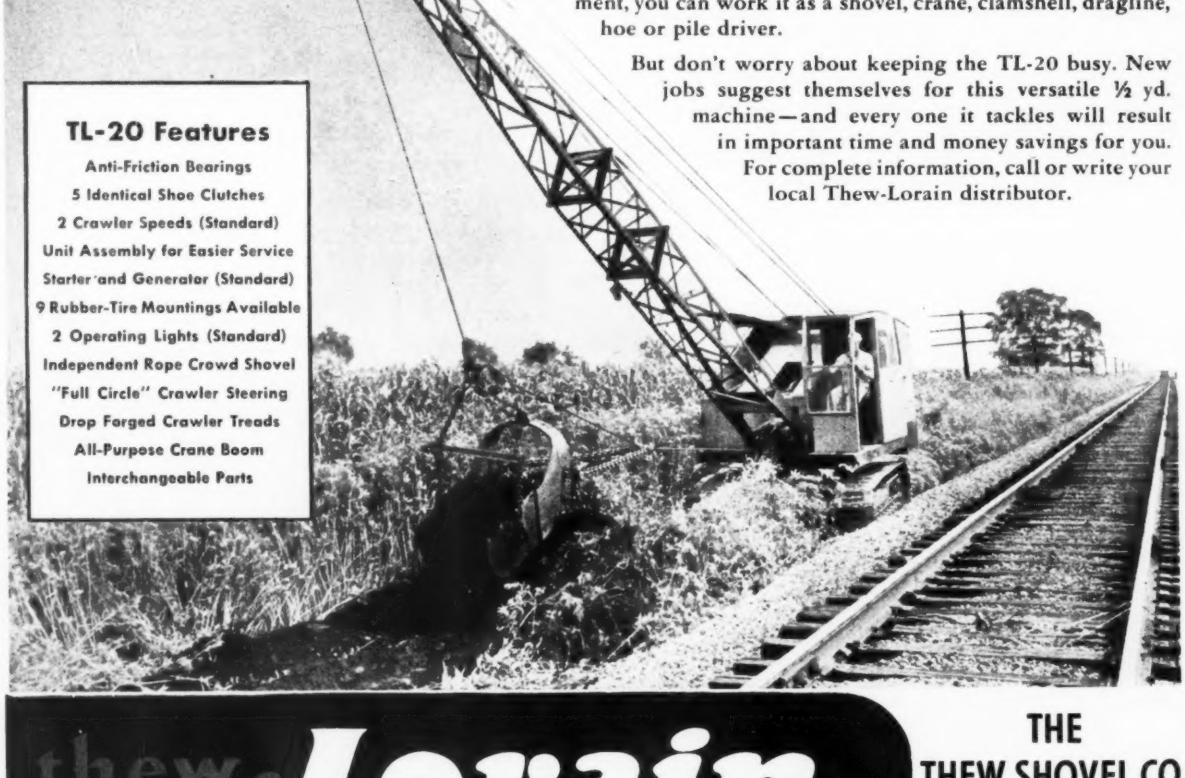
Gradall
Reg. U. S.
Pat. Off.

Give the "right-of-way" to this LORAIN *"one-man gang"*

★ A tidy, well-drained right-of-way is a sign of good railroad housekeeping. And this new Lorain TL-20 dragline of the Illinois Central will soon have this stretch of track in "apple pie order"—at a fraction of the cost of old pick and shovel methods.

"Workin' on the railroad" provides scores of full time jobs for the Lorain TL-20 today. It's streamlined for railroad service. "Unit assembly" of turntable assures high efficiency power transmission with simplified design and easy maintenance. Machine may be supplied with a 2-speed crawler, as pictured, or with any of 9 different highly mobile rubber-tire mountings. And, with interchangeable boom equipment, you can work it as a shovel, crane, clamshell, dragline, hoe or pile driver.

But don't worry about keeping the TL-20 busy. New jobs suggest themselves for this versatile ½ yd. machine—and every one it tackles will result in important time and money savings for you. For complete information, call or write your local Thew-Lorain distributor.



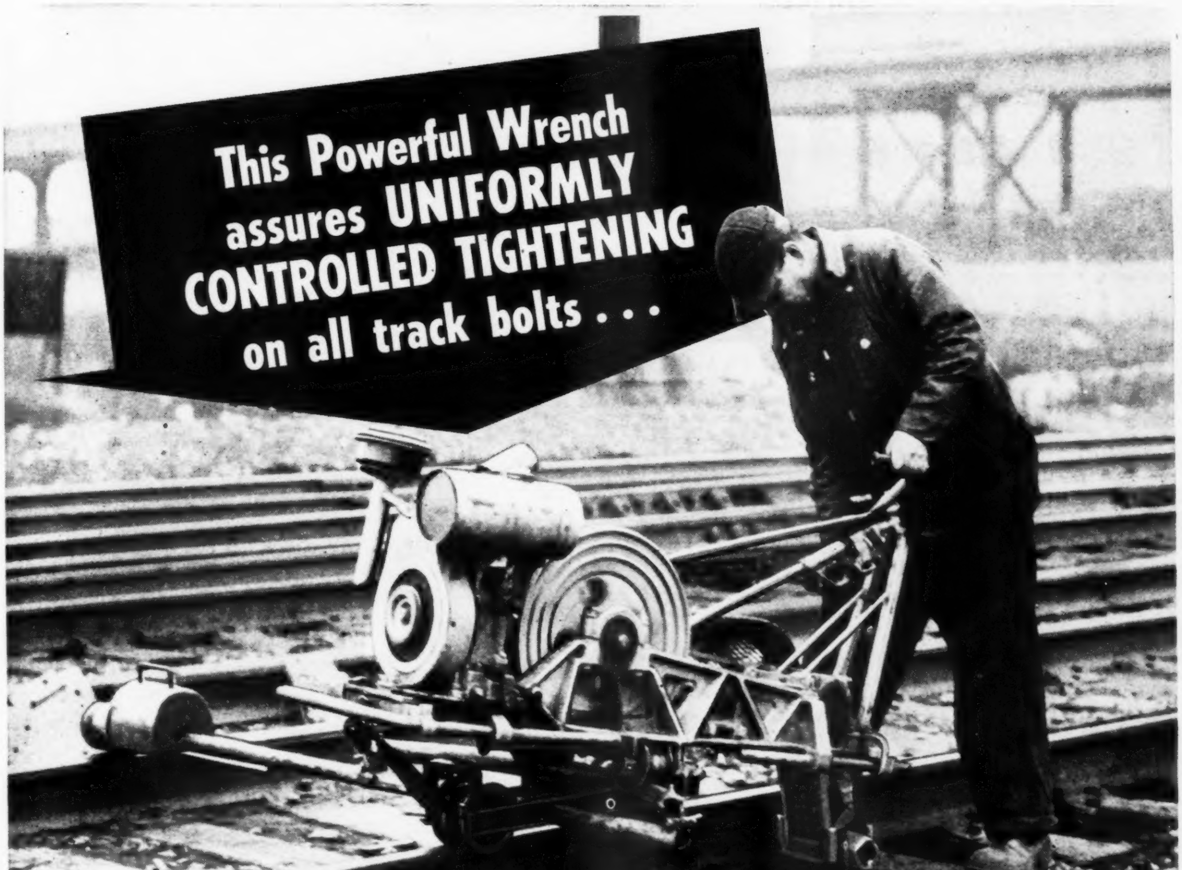
TL-20 Features

Anti-Friction Bearings
5 Identical Shoe Clutches
2 Crawler Speeds (Standard)
Unit Assembly for Easier Service
Starter and Generator (Standard)
9 Rubber-Tire Mountings Available
2 Operating Lights (Standard)
Independent Rope Crowd Shovel
"Full Circle" Crawler Steering
Drop Forged Crawler Treads
All-Purpose Crane Boom
Interchangeable Parts

thew Lorain®

THE THEW SHOVEL CO.
LORAIN, OHIO

CRANES · SHOVELS · DRAGLINES · MOTO-CRANES



—it's the NORDBERG *POWER WRENCH*

You just can't beat the speed and accuracy with which the Nordberg Power Wrench tightens track bolts or removes nuts. There just isn't any comparison between the uniformity you get with this fast, powerful machine and the results you get by using hand methods.

Check the features of the Nordberg tested and proved Power Wrench and you'll see why this rugged, dependable machine should be a "must" on your track maintenance equipment list. *Send for Bulletin 125.*

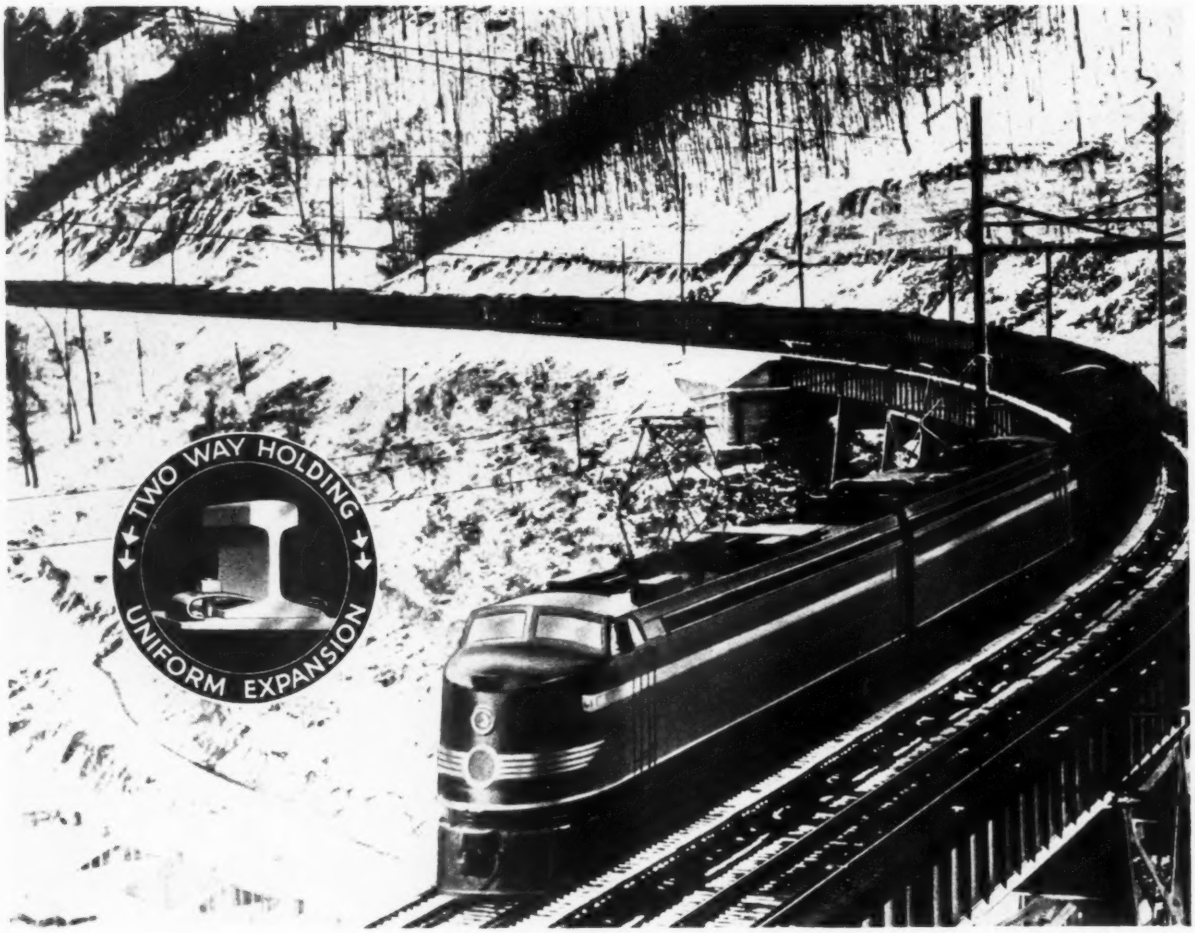
NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN

features . . .

Now powered by 4 H.P. engine ★ Rugged construction ★ 2 socket speeds — low of 35 to high of 122 R.P.M. ★ Removes "frozen" nuts ★ Overload release permits uniformly controlled tightening ★ Reaches nuts at switches and crossings ★ Available with accessories for driving screw spikes and for drilling rail.

NORDBERG TRACK MAINTENANCE MACHINES

ADZING MACHINE • SPIKE PULLER • TRACK WRENCH • SPIKE HAMMER
RAIL DRILL • POWER JACK • CRIBEX • RAIL GRINDER • TRACK SHIFTER



Compression Rail Anchors

Two-way holding has won an enviable reputation among bridge engineers the country over. On exacting bridge and viaduct installations, as well as on main line track, turnouts and crossings, Compression Anchors are providing sound, economical protection against creepage in either direction.

THE RAILS COMPANY

General Office
178 GOFFE STREET, NEW HAVEN 11, CONN.

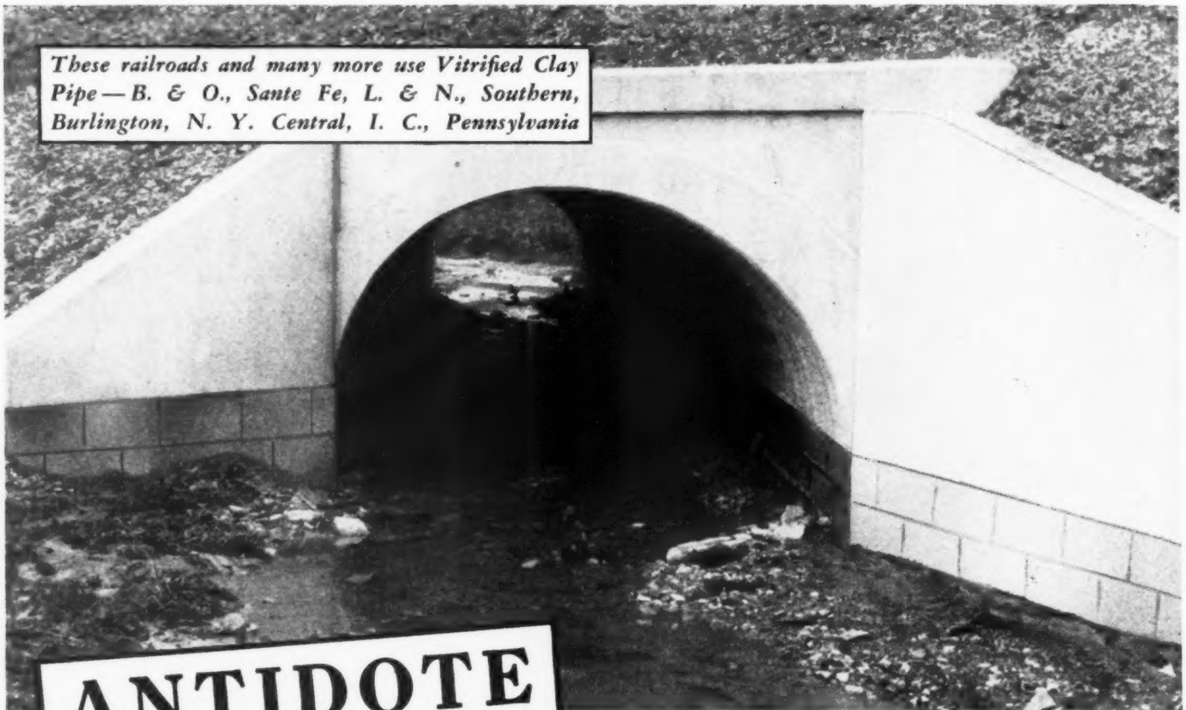
ST. LOUIS, MO. HOBOKEN, N. J. CHICAGO, ILL.

Along more and more roads, Michigan Mobile Shovel-Cranes are shortening maintenance, construction and materials-handling jobs. Michigan's truck mobility, power and traction get it to the job in a hurry, give it greater freedom of movement on the job. This, plus its high operating speed and versatility, simplifies the problem of carrying on work at top efficiency with fewest possible delays to traffic.

Send for your copy of "MICHIGAN SHOVEL-CRANES ON THE JOB."

MICHIGAN

MICHIGAN POWER SHOVEL COMPANY
400 SECOND STREET, BENTON HARBOR, MICH., U. S. A.



ANTIDOTE *for Corrosion*

Vitrified CLAY

JUST east of Pittsburgh, Pennsylvania, engineers recently ran into an area where the streams contained a high concentration of deteriorating acid. Since the project called for eleven culvert structures ranging from 100 to 250 feet in length and ten to forty feet in span, piers and abutments for a 5-span bridge, and approximately 20,000 linear feet of underdrain, this acid presented a serious problem.

Solution? Every single inch of underdrain, mains and masonry that came in contact with the water was constructed of, or lined with acid-resisting *vitrified clay.*

On any installation where resistance to destructive elements is necessary — in terminals, yards, on sidings, crossings, along main tracks — it pays to specify Clay!

For specific information on your Clay Pipe problem, write the details to the office nearest you.

C-248-2A

NATIONAL CLAY PIPE MANUFACTURERS, INC.

1105 Huntington Bank Bldg., Columbus 15, Ohio
703 Ninth and Hill Bldg., Los Angeles 15, Calif.
522 First National Bank Bldg., Atlanta 3, Ga.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.

Vitrified CLAY PIPE

CLAY PIPE NEVER WEARS OUT!

Baffled BY CORROSION'S VICIOUS CIRCLE?

PROTECT *YOUR* PLANT WITH KOPPERS COATINGS!

CORROSION can easily create a vicious circle—a costly circle. To combat corrosion, Koppers makes 6 Industrial Protective Coatings—all specifically formulated to meet varying corrosive conditions.

For example, structures and equipment exposed to corrosive industrial fumes, underground or underwater installations, need the protection of Bitumastic* No. 50—the heavy-duty Koppers Coating. A different set of conditions may call for the use of Koppers Bitumastic* No. 28, or another one of our specialized coatings. In other words, each coating is specified in accordance with the nature of the individual corrosion problem. The result—*effective, lasting* protection of metal, masonry and concrete against corrosion and deterioration.

The ease of application and the long life of Koppers Protective Coatings hold maintenance expense to a minimum. Koppers representatives will gladly help you select the Koppers Coatings that will solve your plant's corrosion problems. Write us for further information.

*Trade Mark Reg. U. S. Pat. Off

KOPPERS

KOPPERS COMPANY, INC.

Dept. 1108T · Pittsburgh 19, Pa.

No. 239 of a Series

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: A Suggestion to "Pass-Along" Readers

November 1, 1948

Dear Readers:

On September 28 I received a letter from a railroad officer which leads me to make a suggestion to many of you—in your interest. It reads in part as follows:

"I read with interest your series of letters in Railway Engineering and Maintenance. In No. 237 (September issue) you speak of 'pass-along' readers. To graduate from that class I am enclosing check for $3 for a two-year subscription. Will you kindly handle further?"

In my September letter, you will recall, I told you that through our "pass-along" readership we have several times the number of readers actually on our circulation lists. We're pleased with that extra readership, and know that we wouldn't have it if our issues from month to month were not worth your passing on to someone else. We know that this large extra circulation is pleasing also to our advertisers, who seek to reach as many of you as possible through our pages.

But I am wondering, as I have for some time, if it would not be a good idea for many of you "pass-along" readers—like the maintenance officer whose letter is quoted above—to graduate from that class. Really, there is nothing selfish on my part in this suggestion, because, in the light of present publishing costs, at our price of $2 a year or $3 for two years, which is the cost of a personal subscription in the United States and possessions and Canada, we'd suffer a real financial loss if all of you "pass-along" readers decided suddenly that you wanted a personal subscription.

True, it would give us a more accurate count of our total readership, which would be gratifying, but I'm thinking about how much more you would get out of Maintenance if each copy you received belonged to you; if you could take each issue home for careful reading; could mark it up, cut out stories or items of special interest, or file it for future reference.

I know only too well—for many of you have told me—that some of you are second, third, fourth, or maybe further down on the "pass-along" list, and that sometimes it is many days after the date of publication before you see the current issue. Furthermore, with a "community" copy, you can't take the liberty you may wish to take, and, no doubt, you must read such a copy more hurriedly and less thoroughly than if it belonged to you personally.

Maybe it has never occurred to you to have your own personal subscription. "Pass-along" copies come to you regularly, even though belatedly, and you have accepted the situation as unsatisfactory, but as one for which there is no ready solution. But there is a simple solution. For as little as $2 a year or $3 for two years—the same price we have charged since 1922—you can have your own personal copy. And if you want to keep abreast of constantly improving maintenance equipment and practices, and are trying to put yourself in line for future advancement, you should have your own copy.

Think this over. You, too, may want to graduate from the "pass-along" class, as many others have. If you come to that conclusion, I shall be glad to have you write to me at the above address, or you may send your request directly to our circulation manager, H. E. McCandless, 30 Church St., New York 7.

Sincerely,

Neal D. Howard
Editor

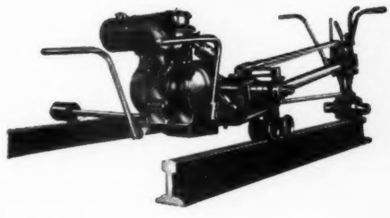
NDH:ag

RACO Power Track TOOLS

DESIGNED [illegible] SAFETY

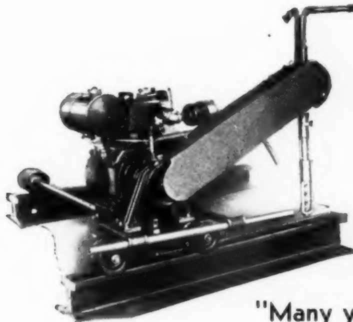
STAR PERFORMERS

TRACK WRENCH



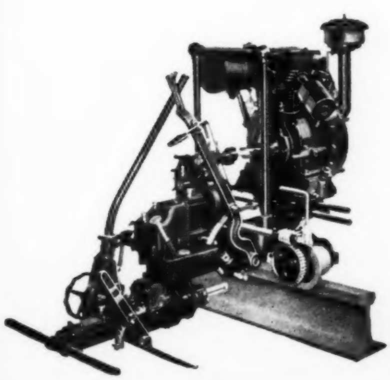
Good engineering using the finest materials throughout has made the Raco Power Track Wrench light in weight and ruggedly powerful.

This means that ease in handling is combined with the ability to stand up, and continue to stand up, under the most severe service.



TIE BORER

"Many years of service boring holes at high speed for cut spikes during rail laying. Holes are straight, accurately placed and of correct depth. Boring proceeds as fast as spike driving."



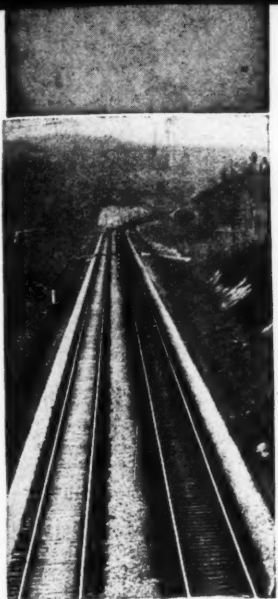
M-W DRILL

The Everett is complete with every necessary adjustment for rapid and accurate drilling. Can be clamped over splice bars or to rail without bars. It will drill rail through splice bar holes.

For Better and Economical Track Maintenance

RAILROAD ACCESSORIES CORPORATION

[illegible] CHRYSLER BUILDING [illegible] 17, N.Y.



Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 West Adams St., Chicago 3

New York 7, 30 Church Street

Cleveland, D.C., 4 1081 National Press Bldg.

Cleveland 13, Terminal Tower

Seattle 1, 1033 Henry Bldg.

San Francisco 4, 300 Montgomery St.

Los Angeles 14, 530 West 6th St.

Dallas 4, 2909 Maple Ave.

Subscription price in the United States and Possessions and Canada, 1 year $2, 2 years $3; other countries in Western Hemisphere, 1 year $5, 2 years $8; all other countries, 1 year $7, 2 years $12. Single copies, 50 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York 7, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.).

PRINTED IN U.S.A.

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

NOVEMBER, 1948

NEAL D. HOWARD
Editor

MERWIN H. DICK
Managing Editor

WALTER L. TURNER, JR.
Eastern Editor

HENRY E. MICHAEL
Associate Editor

NORRIS V. ENGMAN
Associate Editor

S. WAYNE HICKEY
Business Manager

Railway Engineering and Maintenance

Selfishness—

Must Give Way to Policies in the Interest of All

Everyone interested in the railroads—managements, employees, suppliers, shippers, and the public generally—should be concerned about what is happening to the industry—financially and physically. As pointed out recently by Donald V. Fraser, president of the Missouri-Kansas-Texas, before a group of Southwestern businessmen in Wichita Falls, Tex., the railroads are the victims of a gigantic "squeeze play," which threatens the welfare of the greatest of the nation's basic industries. And the problems are being intensified, he said, by the fallacious impression in the minds of so many people, including many railway employees, that the railroads are prospering with the largest peacetime volume of business ever handled in history.

True, the railroads are handling the largest volume of traffic ever handled in peacetime, but false is any thought that, as a whole, they are earning a commensurate return with which to compensate their owners, and to expand and modernize their plants, either through earnings or through investment capital that might be attracted by adequate earnings.

At a time when many other industries are earning a return on their investment in excess of 15 or 20 per cent, and when even some public utilities are earning more than 8 or 9 per cent, it is unreasonable and unfair that the railroads, through regulation, while carrying a prosperity traffic volume, were allowed to earn only 3.46 per cent during the calendar year 1947, and an average of only 3.79 per cent for the twelve months ended July 1 last. In fact, over the past 27 years—including the boom decade of the Twenties and the years of the second World War—the average return earned by the railroads on their net investment, before payment of interest and other charges on indebtedness, was less than 3⅔ per cent a year, and in 1947 thirty-one roads could not so much as break even.

The reason for these continuing small net earnings is to be found largely in the fact that too many are making demands on the railroads, while the roads themselves, through regulation, are restricted in what they can charge for their services to offset these demands. Railroad employees have sought and received higher wages until labor costs are now about 75 per cent higher than in 1939. Suppliers of railway materials and equipment have repeatedly upped their prices until the cost of items purchased by the railroads is now about 100 per cent more than in 1939. Railway taxes jumped from $498,144,000 in 1946 to $936,395,000 in 1947, and are still on the increase.

To offset these rising costs, freight rates, after protracted delays, have been boosted only 44 per cent and passenger fares by only 28 per cent, leaving a spread between income and outgo far too great to be overcome by "just tightening the belt." The result has been and continues to be the starving out of the railroad investor—the men and women whose money has made the railroads possible, and whose continued confidence in railroad credit is necessary if the railroads are to expand, modernize and otherwise improve their services.

It is time someone besides investors become concerned with the low net returns being made by the railroads—and that "someone" should include railway labor, shippers and the traveling public, and railway suppliers. Railway labor should be concerned because, to the extent that the industry suffers from lack of adequate earnings and capital, railway employees will suffer. It cannot be otherwise in the long run.

Shippers and the traveling public should be concerned because they will suffer through poorer service. Railway suppliers will suffer from fewer orders from their customers.

Adequate investment capital is absolutely essential to the health and well being of any industry which must constantly expand and modernize to keep abreast of competition and service demands, and the only way that an industry can attract such capital under the American system of free enterprise is for it to pay a reasonable return on that capital. Unfortunately, the railways, except for train service equipment, have not been able, and are not now able, to raise sufficient capital to carry out many of the improvements necessary and desirable—especially improvements in roadway and structures.

To urge a higher net return for the railways is not to argue that they should be operated for the primary benefit of investors. That is unnecessary and would be undesirable. But neither can the roads be run exclusively for the welfare of the employees, the shippers, the traveling public, or railway suppliers, without regard for the interest and welfare of the other parties involved. Only as each group is willing to subordinate its selfish or primary interest to the welfare of the railroad industry as a whole can the industry prosper, and, in turn, can each of the separate groups benefits most in the long run.

The Cost Problem—

Supervisors Need Fresh Point of View

MAINTENANCE supervisors have had the subject of cost reduction beamed in their direction constantly for so long that it would not be surprising if some of them have acquired a sort of immunity to it, accompanied by a tendency to shrug off further admonitions with the thought that they are "just some more of the same old stuff." Such an attitude is totally incompatible with present conditions.

The maintenance forces are now using labor costing about a dollar an hour for work that was formerly done with labor that cost 40 cents an hour or less. The railroads have endeavored to offset the higher wages by increasing their rates. To some extent they have been successful, but indications are that this approach has strict limitations. Already, "we are beginning to price ourselves out of the market in passenger business and are losing some of the freight," said A. E. Perlman, general manager, Denver & Rio Grande Western, in an address before the conventions of the Roadmasters' and Bridge and Building Associations in September. Mr. Perlman's remarks are reproduced on page 1159 of this issue.

Probably the only sound solution to the high-wage problem is to find ways of increasing the production per man-hour. In meeting his share of this obligation the maintenance supervisor is frequently confronted with something of a handicap. Usually supervisory positions are attained only after many years of service. Because of this long period of seeing things done a certain way it would not be surprising if the thought processes show a tendency to become channelized, and if the viewpoint is sometimes conditioned more by habit and tradition than by the actual necessities of the situation.

Hence, if the supervisor is to be successful in the effort to get more output per man-hour he must often first achieve a fresh point of view regarding his work. Mr. Perlman puts strong emphasis on this point: especially with reference to the use of standard plans, but it is equally applicable to every method, practice and operation involved in maintaining the tracks and structures. All these must be regarded with an attitude of constructive criticism, even suspicion, coupled with a willingness to "go to bat" in putting cost-saving ideas into effect.

Track Machines—

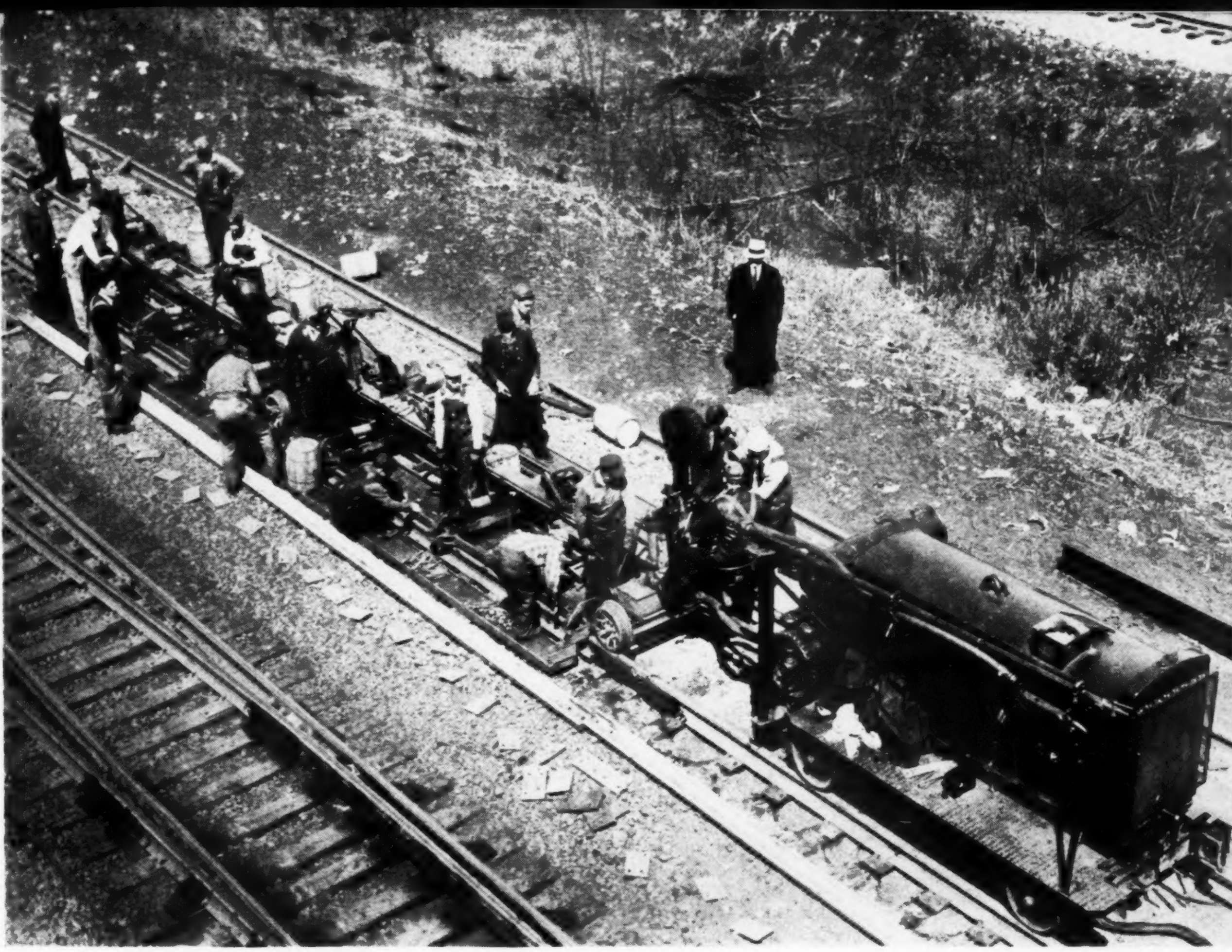
Output is Basic Factor in Selection

TO SAY in the same sentence that both on-track and off-track machines are getting increased attention from maintenance men may appear to be an expression of conflicting thoughts. In reality no conflict is involved. The explanation is that, under the impetus of higher wages for labor, there is a trend toward the more extensive use of *all* types of power equipment, and hence on-track and off-track machines of merit are both sharing in the movement.

Perhaps the foregoing sentence is an over-simplification of what is actually happening. Originally the off-track machine came more importantly into the picture because of the necessity of minimizing interruptions to the work and to traffic, of reducing work train expense, and of counteracting the higher cost of operating some on-track units that resulted from regulations imposed by the labor unions. By and large there has been no alleviation of these considerations; in fact, if anything, they are in some respects stronger today than ever before.

What has now happened to alter the picture somewhat is the introduction in the past few years of several types of new or improved on-track machines that are proving highly satisfactory in service. To permit full advantage to be taken of the possibilities inherent in these machines they are, to a large extent, being used on "dead" track, as a means of reducing traffic interruptions to the minimum. This practice not only requires the cooperation of the transportation department but also an appreciation on the part of maintenance men of its total potentialities, i.e., the opportunity afforded of carrying out various tasks, rather than only one or two, on the stretch of track around which traffic is diverted. Conceivably, transportation officers are apt to look more kindly on the idea of detouring traffic if they are made to realize that maximum use is to be made of tracks given up to the maintenance forces.

In the final analysis, whether a piece of equipment is an on-track or an off-track machine is not necessarily the determining factor in deciding its acceptability in track maintenance. The primary factor is productivity. If the rate and quality of output of a machine are sufficiently attractive, track men may be expected to have the ingenuity to overcome any superficial obstacles that appear to stand in the way of capitalizing on its possibilities.



Looking down on the power machine—gaging six points in each rail length at one time

Power Gaging Machine—

Something New for Large Rail-Laying Gangs

One of the most unusual machines used in rail-laying operations by any road in the country has been developed and built on the Western region of the Pennsylvania. Used in conjunction with the large rail-train organizations on that region, the machine provides for simultaneous six-point gaging of each rail, with the full power spiking of ten ties in each rail length. Combined with a supplemental, yet completely integrated power-spiking organization, full gaging and spiking of the rail is completed, in synchronization with the other rail-laying operations, at the average rate of one rail a minute. This article describes the design and construction of the machine and the method of operation, and gives details of the supplemental operations.

TO IMPROVE the quality of work performed by the man-power available, the Western region of the Pennsylvania has developed two power gaging machines for use in conjunction with the rail-laying operations carried out with its rail-train organizations. These machines, which provide for six-point gaging of each rail length, are each powered and moved by a 500-cu. ft. on-track, self-propelled air compressor, which also supplies air for driving the gaging spikes.

General Set-Up

The power gaging machine is essentially a specially equipped and operated low-wheel carriage, 38 ft. long, which provides for pushing the new rail inward or outward to gage throughout its length by means of a series of air-operated gage rods and clamps, and which carries on several movable platforms the entire force of men involved in gage-spiking operations, including those distributing spikes, setting spikes with hand hammers and driving the spikes with pneumatic hammers.

Supplementing this unit, which is moved forward progressively, one rail length at a time, by the air compressor, is a second air compressor outfit, of 315 cu. ft. capacity, with from three to five pneumatic spiking hammers, which does all fill-in rail spiking and drives certain plate-holding spikes.

The power gager, which is operated as one continuous unit throughout its 38 ft. of length, is essentially two car units, closely coupled together, each mounted on two pairs of motor-car

The gager in action, spiking, with platforms lowered on ties

Moving ahead, with the platforms elevated clear of the ties

type wheels spaced 14 ft. 3 in. apart—with a wheel spacing of 7 ft. 9 in. at the center of the coupled units.

The Frame

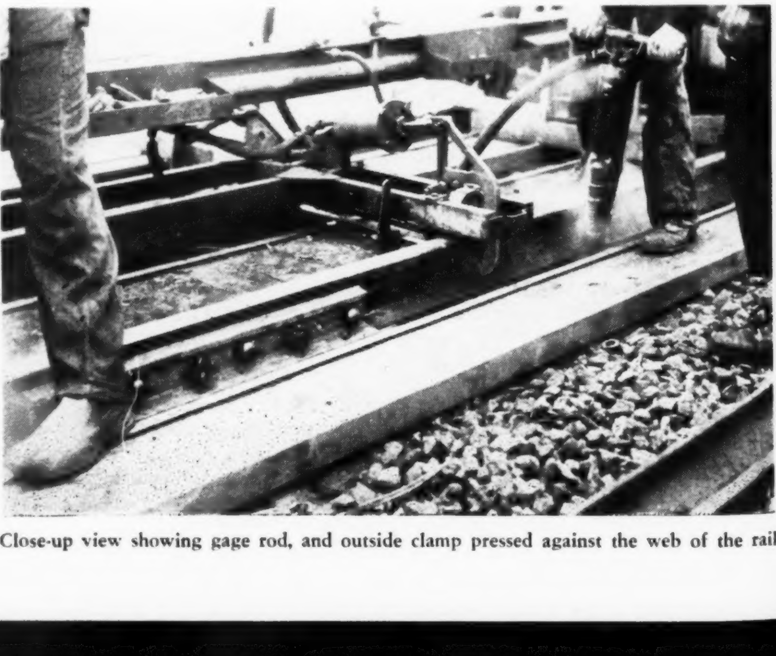
The frame of the gager, as a whole, consists essentially of a heavy T-section member, continuous except for a short gap at the center, which is mounted base up and approximately 18 in. above the top of rail. This frame, or center sill, carries all of the units of the machine, including six combination power gage rods and clamps (two between each pair of wheels); four vertically raising and lowering platforms (two, in line with each other, along the outer side of each track rail); a total of 22 air cylinders of different sizes for the operation of the gage rods, gage clamps and platforms; and all air piping for these units, as well as for the operation of the pneumatic spike drivers. In the main, all of the air piping is carried along and fixed to the sides of the gager center sill, twin outlet valves for the spike drivers being provided at uniform intervals throughout the length of the unit on top of the sill—two between each set of wheels.

The two working platforms on each side of the gager, which are continuous except for the break at the center coupling, each consists of a single 2-in. by 12-in. yellow pine plank, framed along both sides for stiffness by light structural steel channels. The platforms are attached to transverse crossheads at right angles to the main center sill, which, in turn, have direct connections with air cylinders above, by means of which they and the platforms can be raised and lowered. Thus, all four sections of platforms are raised and lowered simultaneously. The raise, being designed to be only sufficient to clear road crossings, switches, etc., when it is desired to move the unit forward, is about 10 in. In their lowered position the platforms come to rest on the tops of the ties, from which position all spiking is done. Operation of the platforms is controlled by an operator at the rear of the unit as a whole, who, from a raised seat where he can observe all operations, also operates the power gage rods and clamps and synchronizes the work as a whole.

The Gaging Assemblies

The six power gaging assemblies, which are spaced about equally along the length of the unit, include six power gage rods and six power rail clamps. Each of the gage rods, which are 1 in. in diameter, is retractable in length through a knuckle joint at the center, so that when the gaging machine is to be moved forward, the rods, under the control of the operator, can be retracted until their opposite ends clear the gage sides of the opposite rails. Simultaneously, the clamps, which contact the outside of the rail at about the center of the web, are drawn outward and upward from the rail, entirely in the clear. When the machine has been moved forward to a new gaging position and brought to a stop, the gage rods are moved outward to true gage length between opposite rails, forcing the new rail out, if necessary, while the clamps are lowered, forcing the rail inward to tight contact against the ends of the gage rods.

On high-speed tangent, the track is gaged to 4 ft. 8¼ in., the recently adopted standard gage for high-speed tangent track on the Pennsylvania, and the gage rods are normally set to this measurement. However, by the addition of shims back of the hard-faced contact tips, the rods can be increased in length as desired, and new tips can be substituted when neces-



Close-up view showing gage rod, and outside clamp pressed against the web of the rail

sary to compensate for wear of the tip.

As only one line of track rails is relaid at a time in the rail-laying operations, the platforms on the new-rail side carry the entire gaging force, together with supplies of spikes and the pneumatic spike drivers. The force involved includes five men with the pneumatic spike drivers, spaced at about equal intervals along the length of the gager (two within each of the 14-ft. 3-in. wheel spacings, and one between the wheels spaced 7 ft. 9 in. apart); five more men, who set the spikes for the hammer men; and three helpers, who open spike kegs along the right-of-way, pile spikes on the gager platforms and center sill within easy reach of the spike setting men, and give such other assistance as may be necessary.

With each setting of the gaging machine over a new rail length, each of the power hammer men drives two spikes in each of two ties, leaving one tie unspiked between the two ties. Thus, ten well-spaced ties are fully gage-spiked with each setting of the machine, requiring the driving of 20 spikes. When this spiking has been completed, which usually requires from 50 to 60 sec., the gage operator blows a whistle, raises the spiking platforms, and signals the compressor operator to move ahead. In the next advance position, after again sounding the whistle, the operator lowers the platforms to working position on the ties, and gage spiking operations are repeated.

Fill-In Spiking

In the fill-in spiking behind the power gager, a 315-cu. ft., track-mounted, self-propelled air compressor is used, with from three to five pneumatic spiking hammers—this outfit usually working from 100 to 1,000 ft. behind the gager, depending upon the working conditions encountered. Three of the hammers are always used, one or two others being added as may be necessary to catch up with the gaging operations. Both this compressor and that used with the power gager are propelled by air motors, this type of drive having been found better adapted to the frequent stopping and starting involved in the work.

Spiking First Line of Rails

In the fill-in spiking of the first line of rails laid, two rail-holding spikes (one on each side of the rail) are driven in each of the ties not spiked in the gaging operation. In addition, one plate-holding spike (on the outer end of the plate) is driven in every tie—making, at this stage, three spikes in every tie.

When driving the fill-in spikes as the second line of rails is brought up, two rail-holding spikes are driven in each tie not spiked during the gaging operations, and, on the opposite rail, a second plate hold-down spike is driven in every tie (on the inner end of the plate). Thus, with the completion of the rail laying, the first line of rails laid has two rail-holding and two plate-holding spikes in each tie, while in the case of the second line of rails laid there are two rail-holding spikes in each tie. Placing the plate-holding spikes in the second line of rails is deferred, pending subsequent working of the track to give it a final line and surface, with such tie renewals as may be necessary. Completion of the delayed anchor spiking of the second line of rails is done during the winter months.

In connection with all of the fill-in and anchor spiking, the spike holes are pre-bored, using two or three self-contained, gasoline engine-driven wood boring machines—working between the power gaging and fill-in spiking operations. Furthermore, all spikes used in the fill-in and anchor spiking operations are hand set, with light hand hammers, by two or three men, as is required, each equipped with a Kershaw one-man spike-setting carriage.

Clearing for Traffic

Since the gaging machine cannot be removed from the track readily to clear for traffic, it is hauled into the clear for trains and at the close of the day by its accompanying self-propelled air compressor. During such moves of the machine, all of the platforms are elevated to their fully raised positions, and are then swung upward to positions directly over the body of the machine, where they are held securely by chain slings.

The power gager described is best adapted for gaging tangent track and relatively light curvature, which makes it particularly well suited to conditions found on the Western region. Where curvature is involved, and especially when heavy rail is being laid, use of the gager calls for the closest supervision to be certain that the rail is brought to true gage.

The power gaging machines being used on the Western region were designed by Pennsylvania employees at Fort Wayne, Ind., and were built in the road's shop at that point. They are operated under the general direction of C. G. Grove, chief engineer maintenance of way of the Western region.

The power gaging machine, with platforms raised within clearance limits, ready to be hauled into the clear by the air compressor

Maintaining Curves With a String—

How to Calculate a Si

Part III of a Series

In this installment, the author presents two specific examples of how to correct the alinement of simple curves with easement spirals, giving step by step the calculations involved. The first curve, for which two solutions are presented, solves out perfectly, and gives the reader a simple example in string lining calculations. The second curve does not solve out perfectly, but the author shows how it can be adjusted to be practically perfect by a slight compounding of the circular portion between spirals. It is important that the fundamentals herein applied be fully mastered by students as a requisite to complete understanding of the solution of compound and reversed curves, to be discussed in subsequent articles.

EXAMPLE No. 1 herewith shows a slate, divided into columns, as heretofore described,* containing the original ordinates of a simple curve and two solutions. The left-hand solution has spirals with a rate of 2, starting at zero and increasing to 10 in five stations. Then the body of the curve has equal ordinates with a value of 10, to the final spiral which decreases at a rate of 2 to zero. The right-hand solution, using the same original ordinates, has spirals with a rate of 1, thus being twice as long, but the body of the curve has been increased by one unit to an ordinate of 11, or a sharper degree, to make up for the increased length of the spirals. Also, the half-throws are materially increased.

The station numbers are listed in Column 1; the original ordinates are entered in Column 2, opposite the station where they were measured. In Column 3, a set of revised ordinates, for both initial and final spirals, as well as the body of the curve, are entered. The total sum of all of these ordinates must be equal to the sum of the original measured ordinates. In Column 4, the difference between the original and revised ordinates for each station is set down, on the same line as the station, with a minus sign (—) before it if the original ordinate is less than the revised ordinate. (See Stations 4, 8, 10, 11, etc.) Column 5 shows the net error at any station and the figures are obtained by adding the figure shown in that column opposite any station, to the difference shown in Column 4 opposite the next station and recording the sum in Column 5 opposite the latter station. Of course, if either figure has a minus sign before it, this indicates that the figure is to be subtracted to find the net error. The arrows between the columns for the first 10 stations show how the additions are made, and are not part of the solution.

In the example, the zero opposite Station 1 in Column 5 is added to the 1 in Column 4 opposite Station 2, making a sum of 1, which is placed in Column 5 opposite Station 2. This 1, added to the zero in Column 4 opposite Station 3, gives a sum of 1, which is placed in Column 5 opposite Station 3. This, added to the —1 in Column 4 opposite Station 4, gives zero, which is placed in Column 5, and so on. As the ordinates are functions of, and proportional to, the central angle of the curve, a zero in Column 5 shows that the revised curve is parallel to the original curve at that station. A positive error indicates that the revised curve is diverging from the original curve toward the outer rail, and a negative error shows that it is approaching the inner rail of the

*One road reports that it has abandoned the use of a slate as described in Part II of this series (see September issue, page 920) and uses sheet acetate which is thumb-tacked to a heavy clip board. On the reverse side of the acetate it puts the columns and lines and column heads in india ink, and uses a colored china pencil for incorporating the data on the acetate. Since the figures can be readily removed with a soft cloth, the acetate can be used over and over again.

1	2	3	4	5	6	7	8	9	10	11	12
Sta. Nos.	Orig. Ords.	Rev. Ords.	Diff.	Sums Diff.	Half Throws		Rev. Ords.	Diff.	Sums Diff.	Half Throws	
0	0	0	0	0	0		0	0	0	0	
1	0	0	0	0	0		1	-1	-1	0	
2	1	0	1	1	0		2	-1	-2	-1	
3	2	2	0	1	1		3	-1	-3	-3	
4	3	4	-1	0	2		4	-1	-4	-6	
5	7	6	1	1	2		5	2	-2	-10	
6	9	8	1	2	3		6	3	1	-12	
7	10	10	0	2	5		7	3	4	-11	
8	9	10	-1	1	7		8	1	5	-7	
9	10	10	0	1	8		9	1	6	-2	
10	8	10	-2	-1	9		10	-2	4	4	
11	9	10	-1	-2	8		11	-2	2	8	
12	10	10	0	-2	6		11	-1	1	10	
13	11	10	1	-1	4		11	0	1	11	
14	11	10	1	0	3		11	0	1	12	
15	10	10	0	0	3		11	-1	0	13	
16	9	10	-1	-1	3		11	-2	-2	13	
17	9	10	-1	-2	2		11	-2	-4	11	
18	10	10	0	-2	0		11	-1	-5	7	
19	11	10	1	-1	-2		11	0	-5	2	
20	12	10	2	1	-3		11	1	-4	-3	
21	11	10	1	2	-2		10	1	-3	-7	
22	9	10	-1	1	0		9	0	-3	-10	
23	10	10	0	1	1		8	2	-1	-13	
24	9	10	-1	0	2		7	2	1	-14	
25	7	8	-1	-1	2		6	1	2	-13	
26	6	6	0	-1	1		5	1	3	-11	
27	5	4	1	0	0		4	1	4	-8	
28	2	2	0	0	0		3	-1	3	-4	
29	0	0	0	0	0		2	-2	1	-1	
30	0	0	0	0	0		1	-1	0	0	
31	0	0	0	0	0		0	0	0	0	

Example No. 1—Two solutions of a simple curve, both of which solve out perfectly

Simple Curve

By W. H. LORD

Assistant Division Engineer
Nashville, Chattanooga & St. Louis
Chattanooga, Tenn.

Mountain territory of the Chattanooga division of the N.C. & St. L., where string lining has been an important factor in improved curve riding conditions

original curve. If the sum of the original ordinates equals the sum of the revised ordinates, the final figure at the end of the curve will be zero. This shows that the total central angle, and no more, has been used, and that the curve ends in a tangent parallel to the existing tangent, but it may not coincide with that tangent, unless the final figure in the next column (6) is zero also. All columns must begin and end with zeros, except the station column, of course.

Value of Half-Throws

Column 6 shows the amount of half-throw necessary to correct the errors, and the values are found by adding together the figures in Columns 5 and 6 for any station, and putting the sum in Column 6 opposite the next station. This is also shown by arrows for the first 10 stations. After figuring a few curves, this becomes almost automatic, and the computer goes through the process without special effort. The zero opposite Station 2 in Column 6 is added to the 1 in Column 5 for the same station and the sum is placed in Column 6 opposite Station 3. This sum (1) added to the 1 in Column 5, gives 2, which is placed in Column 6 opposite Station 4. This is continued, giving due consideration to the minus signs, of course, until the end of the curve is reached, where the final result must be zero. Any error at the end shows that the curve is not in the final tangent by the amount of the error; if positive, it indicates that the curve needs to be thrown inward some more; if negative, that the curve must be thrown in the opposite direction, before the curve is correctly lined. This will be explained later.

The right- hand solution shown in example No. 1 uses the same stations and original ordinates as the left-hand solution (Columns 1 and 2). Columns 8, 9, 10 and 11 have the same headings as Columns 3, 4, 5 and 6 and are used for the same purposes, but with different revised ordinates in Column 8. The differences between Columns 8 and 2 are entered in Column 9, and Columns 10 and 11 are figured exactly the same as were Columns 5 and 6, as shown by the arrows for the first 10 stations. By using two solutions opposite each other on the slate, the throws can be compared readily and the solution best fitted to the particular problem can be selected, or new ordinates can be selected to produce the throws wanted before destroying any solution not wanted. Few curves will ever be found to solve out perfectly as the ones shown in Example 1, and often several solutions must be tried before the final solution is accepted.

Example No. 2

Example No. 2 shows a curve which will not solve out perfectly, but which can be adjusted to be practically perfect by a slight compounding of the circular portion of the curve. Having the stations and the original ordinates listed on his slate, the computer inspects the ordinates in the body of the curve, omitting those on the spirals, and estimates the average value to be 50 in this case. If in doubt, he could add a few of the ordinates together (say 10 or 15), and obtain an average by dividing the sum by the number of ordinates added.

If the unit of measurement used was ⅛ in. and the length of the stations 39 ft., a glance at Table No. 1 will show that the curve which has an ordinate of 50 is a 3-deg. and 57-min. curve. Let us assume that the rules of the railroad involved require 5 in. elevation for a 4-deg. curve at the speed likely to be used at this location. The practical rate of run-off of elevation being between 1 in. in 40 ft. and 1 in. in 80 ft., the spiral should be between 200 and 400 ft. in length. A rate of ½ in. per station gives an easy riding run-off, so the computer adopts this rate, which will make the spiral 10 stations, or 390 ft., long for 5-in. elevation. As the ordinate at the sharp end of the spiral is the same as that of the curve, the rate will be 50 divided by 10, or 5 units per station.

Usually the original ordinates of the spirals will increase nearly at the

1	2	3	4	5	6	7	8	9	10	11	12
Sta. Nos.	Orig. Ords.	Rev. Ords.	Diff.	Sums Diff.	Half Throws		Rev. Ords.	Diff.	Sums Diff.	Half Throws	Remarks
0	0	0	0	0	0						
1	0	0	0	0	0						
2	2	0	2	2	0						E-0"
3	2	5	-3	-1	2						E-½"
4	8	10	-2	-3	1						E-1"
5	16	15	1	-2	-2						E-1½"
6	22	20	2	0	-4						E-2"
7	28	25	3	3	-4						E-2½"
8	28	30	-2	1	-1						E-3"
9	33	35	-2	-1	0						E-3½"
10	39	40	-1	-2	-1						E-4"
11	45	45	0	-2	-3		45	0	-2	-3	E-4½"
12	53	50	3	1	-5	-1	49	4	2	-5	E-5"
13	50	50	0	1	-4	-1	49	1	3	-3	
14	56	50	6	7	-3	-1	49	7	10	0	
15	50	50	0	7	4		50	0	10	10	
16	48	50	-2	5	11		50	-2	8	20	
17	45	50	-5	0	16		50	-5	3	28	
18	47	50	-3	-3	16		50	-3	0	31	
19	45	50	-5	-8	13	+1	51	-6	-6	31	
20	52	50	2	-6	5	+1	51	1	-5	25	
21	54	50	4	-2	-1	+1	51	3	-2	20	
22	50	50	0	-2	-3		50	0	-2	18	
23	53	50	3	1	-5		50	3	1	16	
24	52	50	2	3	-4		50	2	3	17	
25	50	50	0	3	-1		50	0	3	20	
26	44	50	-6	-3	2		50	-6	-3	23	
27	48	50	-2	-5	-1		50	-2	-5	20	
28	52	50	2	-3	-6		50	2	-3	15	
29	51	50	1	-2	-9		50	1	-2	12	
30	50	50	0	-2	-11		50	0	-2	10	E-5"
31	48	45	3	1	-13		45	3	1	8	E-4½"
32	42	40	2	3	-12		40	2	3	9	E-4"
33	33	35	-2	1	-9		35	-2	1	12	E-3½"
34	32	30	2	3	-8		30	2	3	13	E-3"
35	23	25	-2	1	-5		25	-2	1	16	E-2½"
36	18	20	-2	-1	-4		20	-2	-1	17	E-2"
37	13	15	-2	-3	-5		15	-2	-3	16	E-1½"
38	9	10	-1	-4	-8		10	-1	-4	13	E-1"
39	4	5	-1	-5	-12		5	-1	-5	9	E-½"
40	3	0	3	-2	-17		0	3	-2	4	E-0"
41	0	0	0	-2	-19		0	0	-2	2	
42	2	0	2	0	-21		0	2	0	0	
43	0	0	0	0	-21		0	0	0	0	

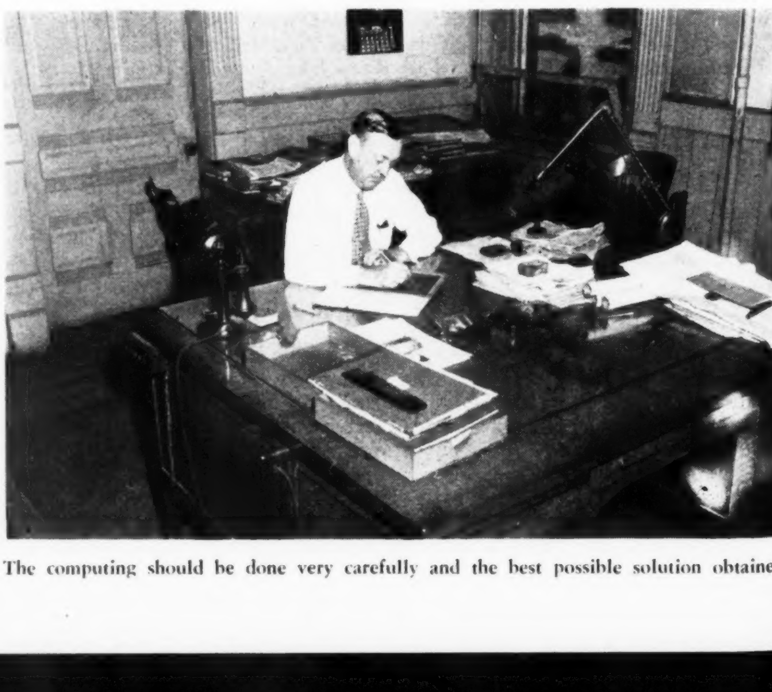
Example No. 2—A solution of a simple curve which will not work out perfectly

same rate and the computer can select the proper stations opposite which to place the revised ordinates for the spirals without difficulty. When in doubt, he can find the sum of the units in the proposed spiral and place the largest term opposite the station where the sum of the original ordinates most nearly equals those in the spiral. If the curve is short, as in the example shown, the sum of the units in both spirals should be deducted from the total sum of all the original ordinates and the remainder divided by the number of stations to which revised ordinates have not yet been assigned. In this case the quotient will be 50. If a few units remain, they should be added one to a station until used up, that is ,that many stations would have an ordinate of 51 instead of 50. Just which stations should have the extra unit cannot be foretold, so it is usually good practice to enter them near the middle of the curve so they can be moved either ahead or back when it becomes necessary to make adjustment for the final error, which usually appears at the first trial.

With trial ordinates assigned to all the stations, Column 4 is computed by entering the difference between the original ordinates and the revised ordinates, exactly as heretofore described. Then Column 5 is computed, with entries opposite the proper stations. If the work is correct, a zero will appear at the bottom of this column, which proves that the sums of the original and the revised ordinates are equal. Then Column 6 is computed. This will seldom come out even; usually there will be an error, either positive or negative. This means that the curve ends in a tangent outside or inside the original tangent, depending on whether the error is positive or negative, and it must be shifted to coincide with the original.

Eliminating Final Error

If the error is positive, the revised curve ends in a tangent outside the original tangent and must be shifted inward; if negative, it is inside and must be shifted outward. In example No. 2 the error is —21 in the half-throws column, which means that the end of the curve is 42 units (⅛-in. units) or 5¼ in. too far in. It is in a parallel tangent because the zero in Column 5 shows that the entire central angle, and no more, has been used and, therefore, that the end of the curve is parallel to the original curve. But, with the tangents not coincident, it means that some part of the curve must be flattened. It is very simple to do this with string-lining notes on a slate, compared with the transit work in re-staking the entire curve or even compounding the curve. It is necessary only to change one or more ordinates by one unit each in one part of the curve and change an equal number of ordinates later in the curve by one unit each, but in the opposite direction. In other words, if a unit be



The computing should be done very carefully and the best possible solution obtained

Tables for Determining the Degree of Curvature From Ordinate Measurements (1/8-in. Units) Using Various Lengths of Stations

TABLE NO. 1

Degree of Curve for Each 1/8" Unit—39-Ft. Stations—4.727' per Unit

Units	0	1	2	3	4	5	6	7	8	9	Units
0		0-05'	0-10'	0-14'	0-19'	0-24'	0-28'	0-33'	0-38'	0-43'	0
10	0-47'	0-52'	0-57'	1-01'	1-06'	1-11'	1-16'	1-20'	1-25'	1-30'	10
20	1-35'	1-39'	1-44'	1-49'	1-54'	1-58'	2-03'	2-08'	2-12'	2-17'	20
30	2-22'	2-27'	2-31'	2-36'	2-41'	2-46'	2-50'	2-55'	3-00'	3-04'	30
40	3-09'	3-14'	3-19'	3-23'	3-28'	3-33'	3-38'	3-42'	3-47'	3-52'	40
50	3-57'	4-01'	4-06'	4-11'	4-15'	4-20'	4-25'	4-30'	4-34'	4-39'	50
60	4-44'	4-48'	4-53'	4-58'	5-03'	5-07'	5-12'	5-17'	5-22'	5-26'	60
70	5-31'	5-36'	5-41'	5-45'	5-50'	5-55'	5-59'	6-04'	6-09'	6-14'	70
80	6-18'	6-23'	6-28'	6-33'	6-37'	6-42'	6-47'	6-51'	6-56'	7-01'	80
90	7-06'	7-10'	7-15'	7-20'	7-25'	7-29'	7-34'	7-39'	7-44'	7-48'	90

TABLE NO. 2

Degree of Curve for Each 1/8" Unit—37-Ft. Stations—5.25' per Unit

Units	0	1	2	3	4	5	6	7	8	9	Units
0		0-05'	0-11'	0-16'	0-21'	0-26'	0-32'	0-37'	0-42	0-47'	0
10	0-52'	0-57'	1-03'	1-08'	1-13'	1-18'	1-24'	1-29'	1-35'	1-40'	10
20	1-45'	1-50'	1-56'	2-01'	2-06'	2-12'	2-17'	2-22'	2-27'	2-33'	20
30	2-38'	2-43'	2-48'	2-54'	2-59'	3-04'	3-09'	3-15'	3-20'	3-25'	30
40	3-30'	3-36'	3-41'	3-46'	3-51'	3-57'	4-02'	4-07'	4-12'	4-18'	40
50	4-23'	4-28'	4-33'	4-39'	4-44'	4-49'	4-54'	5-00'	5-05'	5-10'	50
60	5-15'	5-21'	5-26'	5-31'	5-36'	5-42'	5-47'	5-52'	5-57'	6-02'	60
70	6-08'	6-13'	6-18'	6-24'	6-29'	6-34'	6-39'	6-44'	6-50'	6-55'	70
80	7-00'	7-05'	7-11'	7-16'	7-21'	7-36'	7-32'	7-37'	7-42'	7-47'	80

TABLE NO. 3

Degree of Curve for Each 1/8" Unit—33-Ft. Stations—6.913' per Unit

Units	0	1	2	3	4	5	6	7	8	9	Units
0		0-07'	0-13'	0-20'	0-27'	0-33'	0-40'	0-46'	0-53'	1-00'	0
10	1-06'	1-13'	1-19'	1-26'	1-33'	1-39'	1-46'	1-52'	1-59'	2-06'	10
20	2-12'	2-19'	2-26'	2-32'	2-39'	2-45'	2-52'	2-59'	3-05'	3-12'	20
30	3-19'	3-25'	3-32'	3-38'	3-45'	3-52'	3-58'	4-05'	4-11'	4-18'	30
40	4-25'	4-31'	4-38'	4-45'	4-51'	4-58'	5-04'	5-11'	5-18'	5-24'	40
50	5-31'	5-37'	5-44'	5-51'	5-57'	6-04'	6-11'	6-17'	6-24'	6-30'	50
60	6-37'	6-44'	6-50'	6-57'	7-03'	7-10'	7-17'	7-23'	7-30'	7-37'	60

For 31-ft. stations, 1 deg. of curve for each inch of ordinate.
For 1/16" units, the degree is one-half of above values in each case.
Example—The figures 2-12' in Tables 1, 2 and 3 mean a 2-deg. 12-min. curve for 28, 25 and 20 units, respectively.

ADDED in the first place, a unit must be SUBTRACTED later on to balance it, so Column 5 will still end with a zero, but the error in Column 6 will be eliminated. The rule for reducing or eliminating excess throws is as follows:

If the error is POSITIVE, ADD to the ordinates nearer to the beginning of the curve and subtract from those nearer to the end of the curve. If the error is NEGATIVE, SUBTRACT from the former and add to the latter. The stations at which the ordinates are altered must be taken in pairs and far enough apart that the difference in station numbers equals the number of units to be changed.

To eliminate the error of —21 in Example 2, one pair of ordinates 21 stations apart, three pairs 7 stations apart, one pair 9 stations and one pair 12 stations apart, or any other combination which will make 21, can be used. As it is preferable to keep the spirals perfect if possible, and there are less than 21 stations between the spirals, three ordinates will be changed near the start of the curve and three more, seven stations from them, will be used, in making the correction. As the error is negative, the ordinates at Stations 12, 13 and 14 will be reduced a unit each. As Station 11 is unchanged, the figures in Columns 3, 4, 5 and 6 are repeated in Columns 8, 9, 10 and 11, at Station 11. In the revised ordinate column, the ordinates for Stations 12, 13 and 14 are changed from 50 to 49, and those for Stations 19, 20 and 21 are changed from 50 to 51. All the rest are copied from Column 3, and, starting with the figures set up opposite Station 11, the curve is refigured in the same manner as before. This time there will be no error at the end of Column 11.

Here is what has happened: The curve at Stations 12, 13 and 14 has been flattened by one unit (about 5 min.) and at Stations 19, 20 and 21 it has been sharpened a like amount. These compounds are so short and so slight that the curve can be considered as practically perfect. The throws are greater but not excessive, and if there is nothing to prevent the throw of 7¾ in. at Stations 18 and 19, the problem can be considered as solved.

The first ordinate changed was the final ordinate of the initial spiral. This means that the spiral can be considered as having its rate changed one unit at the last station, or that it was shortened to 9 4/5 stations. In the former, the run-off would still be 10 stations long, or 390 ft.; in the latter, the run-off might be made 9 4/5 stations long, or 382.2 ft., although no harm would result if the full elevation extended slightly beyond the end of the spiral at the tenth station, as the variation would not exceed 1/10 in.

As a guide in selecting units, and changing units when necessary, it is a general rule that no ordinate on the curve may be more than one unit greater or less than the adjoining ordinates, and that the rate on spirals shall not vary by more than one unit at a time. Even an increase of one point at the ordinate where the spiral joins the curve should be avoided, if possible, although a decrease of one unit at that point is permissible.

THIS Crawler-mounted Thew TL-20 dragline is sloping banks and clearing ditches on the Denver & Rio Grande Western near Arena, Colo.

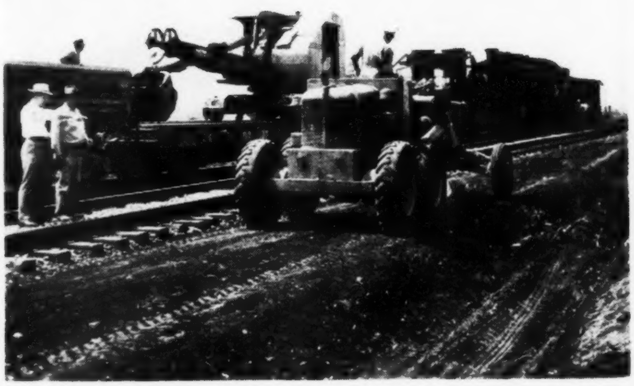
Left—A stretch of main track on the Nashville, Chattanooga & St. Louis near Smyrna, Tenn., before the grading work was undertaken

Below—This view of the same stretch of track shows how the grading work improved drainage conditions, visibility and appearance

Uses Modern Machines to Improve Right-of-Way

DURING the past summer the Nashville, Chattanooga, & St. Louis, using a combination of on-track and off-track equipment, completed a nine-mile cut-widening and grading project near Smyrna, Tenn. The resulting improvements to the property in drainage, visibility and appearance are strikingly shown in the accompanying "before and after" photographs.

On this project the equipment included a work train with a ½-yd. shovel and two 20-yd. air-dump cars, an Allis-Chalmers BD-2 motor grader, a W-Speed Patrol grader and several HD-19 tractors. The shovel was used to dig out the narrow cuts, the material being loaded into the cars and dumped on the shoulders of narrow fills. The Allis-Chalmers off-track equipment was used to work the dirt within range of the shovel bucket, to spread and level the wasted material on the embankment shoulders, and, finally, to grade the banks of the cuts to a three-to-one slope.



Above—Grading shoulders with the Allis-Chalmers BD-2 motor grader while the work train takes siding for a train. Left—Bank grading with the assistance of an Allis-Chalmers HD-19 Diesel crawler tractor

The Supervisor—and Maintenance Costs

The impact of a peace-time economy, with its emphasis on holding costs down, has made it necessary for railroad maintenance men to examine closely their methods and practices, according to Mr. Perlman. This thought—and many other helpful observations—were expressed in an address presented by Mr. Perlman before a joint session of the conventions in September of the Roadmasters' and the American Railway Bridge and Building Associations. This address is reproduced here in full.

Mr. Perlman addressed a joint session of the B.&B. and Roadmasters' meetings

By A. E. PERLMAN
General Manager
Denver & Rio Grande Western
Denver, Colo.

THE supervisor's first reaction to having a general manager discuss holding down maintenance costs is likely to be the thought that "he's going to tell us to cut off more men and use less material!" That is what we were forced to do, as many can remember, in the early 'Thirties in order to keep the sheriff away from the door.

However, during the past six years, the main purpose of the railroads has been to achieve production—to attain ton-miles and passenger-miles of unprecedented proportions with the restricted supply of men and material available. Cost was secondary to volume. Overtime was paid on regular assignments in order to be able to compete in the labor markets.

But today the picture is changing. We are again becoming cost conscious. We are beginning to price ourselves out of the market in passenger business and losing some of the freight. Whiskey from Kentucky is being shipped to the west coast by truck. And again we are faced with additional wage increases. So if we are to keep the railroads dominant in the field of mass transportation, we must help halt spiraling costs.

Must Scrutinize Practices

It now behooves all of us to examine closely our methods and practices in order to meet our changing economy. A famous authority once said: "After something has been in effect in your organization for two years, look it over carefully. After five years, look it over suspiciously. And after ten years, throw it out and start all over again."

This advice may sound extreme. Yet we have standard plans which have been in effect for many, many years, and very few of us question them until someone comes along and asks why do we do a job a certain way. Then, isn't it wonderful when we can take a deep breath and say, "We do it because that is our standard plan." That standard plan represents the best thought regarding the methods and materials available as of the day the plan was made. If thirty years later better methods and materials are available, certainly it is a poor policy to take refuge in the answer: "We do it because it is our standard plan."

If at this gathering methods are discussed which fit the more modern tempo of our operations, or new materials and machines are to be seen at the exhibits, you will be doing your railroad a great service by calling them to the attention of the officers who are responsible for your being here. You are the line officers on whom they depend to keep your needs before them.

If you participate actively in the work of these associations and have means for group discussions within your individual organizations, you can help your railroad keep up to date in its methods and materials. I mention group discussions within your own organization because so often the men designing a structure are prone to think in terms of what appears to them to be the most economical design. Yet they may overlook the fact that the requirements in the field for its construction may be very costly or hazardous. On the other hand, the men in the field may ask for a structure which is easiest to build, yet which might prove very costly in its materials requirements It is only through a compromise of the two viewpoints that the most efficient structure can be designed.

On your way home, if you pass over the other man's railroad, don't have the attitude that you are in a hurry to get back and tell your people how much better your own railroad functions. It's strange, but that seems to be the reaction of a great majority of people. Try to take back something of value that can be put into effect on your own road. The railroad over which you travel may be large or small, yet if you study it with an open mind, you will find practices which can help you improve your own operations. The sight of a half-yard dragline cleaning cuts on an eastern short line was responsible for revolutionizing the Rio Grande's maintenance operations. Pioneering in the use of off-track work equipment helped give us one of the lowest maintenance ratios in the west.

The factor that can do more toward reducing maintenance costs on your own division than any other is conscientious and open-minded, on-the-ground supervision of all activities under your jurisdiction. In that way you become fully familiar with the men, methods and materials which go to make up each operation and will have all the facts at hand with which to make decisions.

Each of your foremen is an individual, subject to your influence and

example. It is only by constant study of each individual that you will be able to put the right man in the right job. It almost sounds like a worn-out rubber stamp when I say that, as a supervisor, you are judged by the men you are gathering around you. Don't be afraid to have men in your organization who know more about certain phases of the work than you: they will add to your own effectiveness. If you came up through the ranks, try to hire some technical graduates. If you are technically trained, gather around you the best practical talent you can obtain and heed carefully their advice. Take in as many young men as you can absorb. They will sometimes ask what appear to you to be elementary questions. But in answering their "whys" you can keep your own thinking young and modern.

When you have selected a man whose ability has been demonstrated in the performance of his work, his general intelligence and training are known to you. But it is important that you help him plan his work; that you ascertain whether or not all materials needed and tools required are on hand for progressing the work with minimum delay. A full understanding should be reached with him regarding the handling of each operation and its completion date. Have data available so that you can show him currently his unit costs. And make him cost conscious by giving out comparative unit costs for gangs doing similar work. Frequent inspection of the progress of the work, together with adequate current cost data, will quickly uncover any poor practices or uneconomical methods.

Selection of Materials

Careful study should also be given to the proper materials needed for a particular job. Most of you are probably thinking: "What authority do we have regarding the materials that are purchased for our operations—the specifications in practically all cases come from the general office." That may be true, but the men in the general office responsible for these specifications lay great emphasis upon your recommendations. This is proved by the fact that you have been asked to attend these meetings and to consider carefully the display of new materials and equipment which is a part of this convention. You men have more intimate knowledge of the desired functions of the materials which you use than have most men in the general office. Your recommendations regarding the length of life, resistance to the elements, wearing qualities and adaptability of materials, and many other factors, are of major assistance to those having the final authority for their selections.

On the Rio Grande, technicians in our laboratory are constantly at work examining and testing new materials and supplies. At the same time they are checking closely on the quality of materials and tools already in use to see that standards are maintained. The results of these laboratory examinations are readily available to the roadmasters and the bridge and building supervisors to aid them in making recommendations. No doubt your own railroad has a similar department which could be helpful to you.

Planning in the choice of tools for each particular operation is necessary if we are to reduce labor costs and save material. When supplied with good tools which tend to reduce hard manual labor, employees are more satisfied. This reduces labor turnover and the cost of training new men.

When Buying Equipment

In considering the purchase of power tools and work equipment, one must consider performance. Will the piece of equipment under consideration do the job? What are its portability features? What is its utilization rating; that is, will it be idle much of the time? How economical is its operation? Is it easy to use? Will it require an experienced operator or can it be operated by most anyone after minimum proper instruction? These are but a few of the questions a supervisor has to ask himself in selecting the proper piece of equipment to perform a specific job.

A supervisor should be thoroughly familiar with the complete operation of the power tool or piece of work equipment in order to enable him properly to instruct others in its operation and know what to realize from it. A machine that is used but partially or incorrectly through ignorance defeats its purpose. Such a condition should not be allowed to exist. The responsibility, therefore, devolves directly upon the supervisor to see that the maximum output of all machines under his jurisdiction is maintained at all times. This requires a great deal of knowledge and planning on the part of the supervisor.

The scheduling of work to obtain full utilization from these machines involves many things. The machines have to be where they are needed at the time they are needed, and in perfect repair. Supplies, such as fuel, lubrication, parts, and appurtenances should be available in the immediate area where the machines are working to minimize loss of time in keeping the machines serviced. Although this sounds rather obvious, it is surprising how much time can be and is lost through incomplete planning of these simple functions.

In track work, interruptions by trains create a problem which requires the exercise of a lot of thought and ingenuity. Much depends upon the amount of cooperation between the maintenance-of-way department and the transportation department in planning the train movements and working time of the track forces to allow the fullest possible use of the men and equipment. The routing of trains to permit uninterrupted use of a track in multiple-track territory and the fleeting of trains at certain periods of the day on single track have both proved practical in achieving this end.

Off-track work equipment, which has proved to be such a boon to the railroads, should be utilized to the greatest possible extent, as its versatility and economy have been fully demonstrated.

While we are thinking of cutting down maintenance costs, we must also remember that in order to have the funds to spend on maintenance operations, we must have the traffic to furnish the revenue. And there are many ways in which the supervisor can be helpful in this respect.

In Northern Idaho one of the lumber mills needed a road crossing over six tracks because its logging railroad had broken down, requiring that logs be trucked in. The roadmaster of the transcontinental line serving the mill told the manager that it would take considerable time to get authority from headquarters to furnish the men and materials for this job, but that if the mill could furnish the plank, he would see that they were immediately put in. This was done, and today the manager of the mill holds the roadmaster in higher esteem than the traffic man who brings him cigars. The railroad saved the cost of the crossing plank, as well as gaining additional competitive traffic.

Later the representatives of a large industrial organization which was planning a new plant came out to look over proposed locations on two competing railroads. Foundation conditions on both roads were a real problem, but the visitors were furnished complete data by one of the bridge and building supervisors. The company decided that if that particular railroad was so helpful, it was by all means a line on which they desired to locate. Here again a maintenance officer was able to do a great deal more than any traffic man could have accomplished.

Bridge and Building section

President Hancock convening the meeting

Chicago Meeting Develops Answers to Many Questions

Committee reports and addresses give attention to a variety of problems confronting the bridge and building forces today. Attendance at new peak

WHAT new problems has the increased use of Diesel locomotives created for the bridge and building forces? What practices in the housing of these forces contribute to improved employee morale? What have researchers to say about the possibility of getting better concrete? What are some of the economic problems involved in replacing timber trestles with other types of construction? These are some of the many questions that were answered in committee reports and addresses presented at the annual convention of the American Railway Bridge and Building Association, held at Chicago on September 20-22.

Why It Was Successful

This meeting was a notable affair for several reasons. It was the third to be held by the bridge and building group simultaneously with the annual convention of the Roadmasters' Association, both meetings being held in the Stevens hotel. Other factors combining to assure the success of the convention included the presence of the Railroad Fair at Chicago, and the scheduling by 13 committees of the American Railway Engineering Association of meetings in Chicago during the conventions in order that their members could have the opportunity of sitting in on sessions of particular interest to them. Some of the A.R.E.A. committees were also influenced by the presence of a large exhibit in the Stevens hotel at the time of the meetings. This exhibit featured the products of 93 member companies* of the Track Supply Association and the Bridge and Building Supply Men's Association.

These special events helped to boost the total attendance at the two meetings to a new high since the practice was started of holding them simultaneously. The registration of members and guests of the two associations for the three-day period amounted to 900, which compared with a total registration of 765 members and guests in 1947.

A detailed report of the Roadmasters' meeting, which included all the committee reports in full, was presented in the October issue. This report also included an account of the events that transpired at a number of joint sessions of the two groups.

As reported last month the two meetings were convened in a joint session on Monday morning, September 20, which was presided over jointly by J. S. Hancock, bridge engineer, Detroit, Toledo & Ironton, and president of the Bridge and Building Association, and A. B. Chaney, assistant engineer maintenance of way, Missouri Pacific, and president of the Roadmasters' Association. All separate sessions of the Bridge and Building group were directed by Mr. Hancock, assisted by E. H. Barnhart, division engineer of the Baltimore & Ohio, and first vice-president of the association.

The principal feature of the joint opening session was an address by J. H. Aydelott, vice-president, Oper-

*A complete list of these companies, including the names of the representatives present and the products displayed, was presented in the September issue.

E. H. Barnhart
First Vice-President

W. F. Martens
Second Vice-President

W. A. Huckstep
Third Vice-President

Guy E. Martin
Fourth Vice-President

ations and Maintenance department, Association of American Railroads. At a subsequent joint session on Tuesday afternoon the combined groups heard an address by A. E. Perlman, general manager, Denver & Rio Grande Western, who spoke on "How the Roadmaster and Bridge and Building Supervisor Can Help Hold Down Maintenance Costs." A second address during the same joint session was presented by O. H. Carpenter, general roadmaster, Union Pacific, who spoke on "Safety Problems as Affected by Diesel Operation and the Increased Mechanization of Maintenance Work." The addresses by Messrs. Aydelott and Carpenter were abstracted in the October issue. The address by Mr. Perlman is presented in full elsewhere in this issue.

Remarks by the President

Addressing the opening separate session of the Bridge and Building Association, President Hancock, explaining that he was deviating from the usual practice of giving an account of his stewardship for the year, spoke of the accomplishment of the association in "coming through two major wars and a major depression within a period of 20 years, emerging in a condition to stand on its own feet." He expressed the hope and belief that "this organization can soon reach the place where railroad management will consider its existence imperative."

The president urged members to assume committee work willingly and to contribute freely of their knowledge. He also requested their cooperation in obtaining new members, saying that this can be done better by personal contact than in any other way. As the result of a membership drive directed by W. F. Martens, general foreman of bridges and buildings, Atchison, Topeka & Santa Fe, San Bernardino, Cal., and second vice-president of the association, a total of 97 new active members were added last year and 144 new members this year, said President Hancock.

He then read excerpts from a letter received from F. M. Misch, general bridge and building supervisor, Southern Pacific, who described how he had enlisted the cooperation of the management of his road in organizing local meetings of the bridge and building supervisory officers on his road for the purpose of reviewing the committee reports and other material presented at the convention last year. This was done for the benefit of West Coast members who were unable to attend the convention.

Mr. Misch said that the first meeting was held in Tucson, Ariz., on January 8, 1948, and that those present included all of the supervisors and assistant bridge and building supervisors from the company's southern divisions, a total of 16 employees. The next meeting was on January 21, 1948, in San Francisco, at which time all of the bridge and building supervisors and assistant bridge and building supervisors from all northern districts were present, a total of 27.

Principal items on the agenda of the separate sessions of the Bridge and Building Association included two addresses and eight committee reports. George M. Hunt, director, Forest Products Laboratory, U. S. Department of Agriculture, Madison, Wis., spoke on "The Protection of Wood in Railway Bridges and Buildings," and Dr. Ruth G. Terzaghi spoke on the question: "If the Railroads Are Not Securing Good Concrete—Why?"

The following subjects were covered by the eight committee reports: "Good Housekeeping to Promote Safety and Fire Protection"; "Protection to Bridges Over Navigable Streams"; "Types of Bridges for Replacing Timber Trestles"; "Enlarging and Relining Tunnels for Present-Day Traffic"; "Housing Bridge and Building Employees"; "Recent Developments in Fuel-Oil Storage and Servicing Facilities for Diesel and Oil-Burning Locomotives"; "Sanitary Facilities and Appurtenances for Railway Buildings"; and "Eliminating Waste of Water."

Another item on the program was a motion picture entitled "Mortar and Glass." Produced by the American Structural Products Company, a subsidiary of Owens-Illinois Glass Company, this picture demonstrated the proper method of laying up glass block panels.

At the Monday afternoon session a certificate of honorary membership in the association was awarded post-

---

Bridge and Building Association

Officers 1947-48

J. S. Hancock, president, br. engr., D.T. & I., Dearborn, Mich.

E. H. Barnhart, first vice-president, div. engr., B. & O., Garrett, Ind.

W. F. Martens, second vice-president, gen. fore. b. & b. & w.s., A.T. & S.F., San Bernardino, Cal.

W. A. Huckstep, third vice-president, gen. bldg. supv., M.P., St. Louis, Mo.

Guy E. Martin, fourth vice-president, supt. w.s., I.C., Chicago.

Elise LaChance, secretary, Chicago.

C. R. Knowles*, treasurer, supt. w.s. (retired), I.C., Chicago.

Directors

F. R. Spofford, asst. div. engr., B. & M., Dover, N.H.

H. M. Harlow, asst. gen. supv. b. & b., C. & O., Richmond, Va.

H. B. Christianson, prin. asst. engr., C.M.St.P. & P., Chicago.

Lee Mayfield, res. engr., M.P., Houston, Tex.

F. M. Misch, gen. b. & b. supv., S.P., San Francisco, Cal.

W. D. Gibson, w.s. engr., C.B. & Q., Chicago.

*Deceased.

humously to the late C. R. Knowles, formerly superintendent of water service of the Illinois Central and treasurer of the association. The presentation was made by Guy E. Martin, present superintendent of water service of that road.

An interlude in the three days of business sessions was a banquet on Tuesday evening, which was tendered to members of the two associations and their families by the Track Supply Association and the Bridge and Building Supply Men's Association. This affair was attended by 1230 persons.

New Officers Elected

In the election of officers at the closing session Mr. Barnhart was advanced from first vice-president to president; W. F. Martens was advanced from second vice-president to first vice-president; W. A. Huckstep, general building supervisor, Missouri Pacific, St. Louis, Mo., was promoted from third vice-president to second vice-president; Guy E. Martin was advanced from fourth vice-president to third vice-president; F. R. Spofford, assistant division engineer, Boston & Maine, Dover, N.H., was elected fourth vice-president; and L. C. Winkelhaus, architectural engineer, Chicago & North Western, Chicago, was elected treasurer. Directors elected were: H. M. Harlow, assistant general supervisor bridges and buildings, Chesapeake & Ohio, Richmond, Va. (re-elected); V. E. Engman, chief carpenter, Chicago, Milwaukee, St. Paul & Pacific, Savanna, Ill.; and G. W. Benson, supervisor bridges and buildings, Central of Georgia, Macon, Ga.

Eight subjects were chosen for investigation by committees during the coming year as follows: "Installation and Maintenance of Built-Up Roofs"; "Fire Protection for Bridges and Trestles"; "Safety in the Transportation of Men and Materials"; "Prolonging the Life of Ties on Bridges and Trestles"; "Developments in Modern Methods for Watering Passenger Cars"; "Methods of Preventing and Removal of Corrosion from Steel Structures"; "Pier Construction and Maintenance on Waterfront Terminals"; and "Disposal of Liquid Waste at Engine Terminals."

Indicating that the practice of holding this convention concurrently with that of the Roadmasters' Association is proving highly satisfactory is the decision to continue the practice next year. The tentative dates for next year's meeting are September 13-15.

All eight committee reports presented during the meeting are published in full in the following pages, with abstracts of the discussions that followed their presentation. Also included are abstracts of the addresses by Dr. Terzaghi and Mr. Hunt.

Better Wood Protection

IN his address on the Protection of Wood in Railway Bridges and Buildings Mr. Hunt advised his listeners not to wait for new developments to solve their wood protection problems. He further advised them to make use of these new developments as they prove their worth, adding that, for the most part, "your success will depend upon continued study and application of known principles of good practice."

Probably the most significant new fact about wood and its use in railway structures, said Mr. Hunt, is its high cost and the high cost of the labor and materials needed to build it into useful structures. This, he said, places new importance on methods of avoiding wood waste, of making wood give longer service, and of reducing labor costs.

Mr. Hunt suggested that consideration be given to the question of increasing the retention of creosote in bridge timbers. Saying that the percentage increase in the cost of the completed structure would be relatively small, he added that this cost would be "greatly outweighed by the increased insurance of long life without repairs because of decay."

He believes that "we are making steady progress in the development of new and superior preservatives, "but it takes a long time to establish superiority because the old preservatives, in their respective fields, give such excellent results." There are two groups of new materials worth watching, he said. One of these groups is that which includes pentachlorophenol, copper naphthenate, and other oil-soluble toxic chemicals. The products in this group, he said, "are giving excellent promise." The second group consists of water solutions of mixed chemicals which, after injection into the wood and subsequent seasoning, deposite mixed salts or double salts that are "highly resistant to leaching and, at the same time, are highly toxic to fungi and insects."

Attention was given by Mr. Hunt to new developments in the seasoning of timber. In this connection he described a new method for the prompt treatment of green timber that depends upon the ability of the vapors of organic liquids at high temperatures to remove water from wood.

Bridge and Building section

As used to date for poles and ties this method "appears to be giving good results and is finding wider use."

The Concrete Problem

IN speaking on the subject, "If the Railroads Are Not Getting Good Concrete—Why" Dr. Terzaghi did not purport to give all the answers but she gave enough evidence to indicate that everything is not right with the concrete manufactured today. Noting that the trend over the years has been toward the production of concrete with a higher early strength, Dr. Terzaghi said that "there are reasons for believing that we may be paying for at least a part of the high early strength of modern concrete by sacrificing durability."

Discussing the causes of concrete deterioration, Dr. Terzaghi divided these into four groups: the aggregates, the cement, the concrete manufacturing processes, and the environment. Two methods are open to the engineer for determining the suitability of aggregates, she said. One of these is the examination of service records of concrete structures already in existence, and the other is reliance on laboratory tests. The first is unreliable, she said, while the second is not always satisfactory because the concrete technologist is finding it increasingly easy to say "no" to an increasing variety of aggregates.

Much of Dr. Terzaghi's address was given over to a discussion of the changes in cement that have occurred over the years, and their effect on the quality of concrete. The changes referred to are the introduction of finer grinding about 1930 and a gradual increase in the lime content of the cement. The result of these changes, she said, has been an increase in the heat of hydration of the cement paste, with ensuing troubles due to volume and length changes.

Explaining that the presence of water in concrete is the cause of many of the troubles being experienced today, Dr. Terzaghi said that a possible solution is to "keep the mix dry in the first place, and to place it with all the arts and knowledge and skill we possess." In getting better results with concrete she referred to the use of such modern aids as air entrainment, the vibrator, and curing compounds.

Eliminating Waste of Water

Report of Committee*

IT IS estimated that the annual cost of water for the Class 1 railways of the United States amounts to approximately $35,000,000, and that the annual cost of maintaining water stations is approximately $15,000,000. This large expense indicates that water is one of the most extensively used commodities by the railways and that careful and painstaking practice is justified in preventing even a small percentage of leakage and waste.

A large part of the water now used by the railroads for steam generating purposes is treated with lime, soda ash, or compounds, and the cost of this water is considerably greater than that for untreated water, which is an added reason for preventing water waste under present-day conditions. Water and air have been considered to be free and common-place for daily use. However, underground water levels are receding and surface supplies are becoming polluted, and both supplies are becoming more expensive to pump and condition. To a certain, but perhaps less noticeable, extent, our water reserves, like our timber and mineral reserves, have reached a point where conservation should be practiced in many localities.

Water Column Waste

Considerable water can be wasted by overflowing engine tenders. This can be eliminated by cooperation between water service men, engine foremen, trainmasters and track supervisors, working together to correct faulty conditions. Water service men should see to it that water columns are maintained to a high standard, that the water flow is at full capacity, and the valve closure effective and dependable; also that the grab irons, chains and operating parts handled by engine crews are in good operating condition. The interiors of column pits should be inspected frequently for leakage. The drains from the pits are concealed and potential leakage hazard exists between infrequent inspections. Engine foremen and trainmasters should impress engine crews with the understanding that tender overflow is expensive and unnecessary. In some cases the cost of treatment of water used for locomotives exceeds the cost of the water itself. Track supervisors should be alert to report offenders as the wasted water creates extra expense for maintaining track at water column locations.

The hydrants at cinder pits and for dispensing drinking water are often permitted to flow continuously when not in use for the purpose for which they were installed. In the case of the cinder pit hydrant the usual excuse is that it is done to prevent freezing. This condition could be corrected by enclosing the hydrant in a frost-proof box or by using a self-draining valve. Hoses should be fitted with quick couplings so they

E. R. Schlaf
Chairman

may be uncoupled and drained after each use. In some cases leaking cinder pit hydrants could be corrected by better maintenance and better cooperation between the water service man and the parties using the hydrant.

In the case of drinking water hydrants, which are often permitted to flow continuously, the reason usually given is that the flow is necessary to keep the water cool. Where such a condition prevails, the use of ice or electric coolers should be considered. In other cases continuous flow is used to neutralize the effect of tastes and odors in the water. In such cases consideration should be given to the use of bottled water, combined with coolers, as more economical and attractive than the natural supply. A type of natural water with limited amounts of iron can be conditioned satisfactorily by the use of coolers alone, and does not require continuous flow to improve color or taste.

Plumbing and Power Equipment

In large office buildings, shops, and power plants where a relatively large amount of plumbing fixtures, piping and valves exist for conveying water and steam, careful attention should be given to water consumption. In cases where congested plants exist, some responsible employee should be delegated to correct water and steam leaks. The power plant or building engineer, plumber or water service man should make inspections at suitable intervals for leaking fixtures, and should take a daily reading of the master meter supplying water to the premises at about the same time each working day. If these readings, when compared, indicate leakage or unusual use of water, the office in charge should make immediate investigation to discover and correct the cause of the increased registration. Municipal water departments usually render bills on a monthly basis, and if leaks or waste should start in the early part of the cycle, much valuable time may be lost before the increased water bill rudely awakens the customer to the knowledge that water leakage is indeed expensive when permitted to exist for any considerable period of time.

The unnecessary use of sprinkling and wash-out hose around shops can also waste considerable water. Engine tenders filled on the inbound track are sometimes emptied on arrival in the house for cleaning and repairs. This practice may be corrected by a better understanding between the men handling the engines.

The automatic valves controlling the inlet of additional or cooling water into power-house heaters and enginehouse wash-out tanks should be inspected at suitable intervals to detect any leakage. The outlets and overflows from heaters and tanks should be of the visible type, with an air gap before entering the sewer, so that unusual overflow or waste can be readily observed.

The automatic valves and float switches controlling the high water level in roadside tanks should also be inspected and repaired on a schedule planned to prevent water overflow. Such overflow is wasteful in warm weather and both wasteful and unsightly when the overflow freezes. Tanks and supports can be so heavily covered with accumulated ice from this cause that the safe load factor may be exceeded and falling ice may become a hazard to people in the immediate vicinity.

Leakage in Underground Mains

The foregoing discussion has described surface and fairly visible conditions that can be corrected by routine inspections and reasonable diligence. However, the most troublesome and expensive water waste occurs in underground mains and supply pipes. If such leakage is suspected or known to exist, a great deal of checking with test meters, leak detectors and special survey work is indicated. An intensive survey should be carried out and repairs made to prevent leaks and waste that can be corrected without unreasonable expense. The balance of the unaccounted for loss of water may necessarily have to be tolerated as a lesser evil.

Underground leaks are often expensive to repair when they occur in congested terminals where the mains are laid under tracks, switches and other structures. The grade at many terminals has been progressively raised over the years and water mains originally installed in a trench of moderate depth have, as a result, been further covered to excessive depth with various kinds of filled material often unsuitable for water pipe coverage. This condition, plus vibration from trains using nearby tracks, increases the tendency to leaks and also increases the expense of making repairs.

When leaks of this kind occur, it is suggested that the jointing material be renewed or solidly recalked, and, in addition, that a bell joint clamp be applied before

*Chairman of this committee was E. R. Schlaf, assistant superintendent water service, Illinois Central, Chicago; vice-chairmen were J. A. Jorlett, master carpenter, Pennsylvania, Pittsburgh., Pa., and R. H. Morrison, principal assistant engineer, Bangor & Aroostook, Houlton, Me.

backfilling. It has been found that the progressive applications of these clamps has stopped leaks of the repeating type which occurred at short intervals in the same joint due to vibration from trains or unfavorable soil conditions. Consideration should also be given to the application of joint clamps on new pipe lines when such lines are installed in locations where conditions may become unfavorable for the standard joint.

In cases where pitted or sub-standard sections of water mains are known or suspected to exist, such sections should be renewed with sound pipe rather than be allowed to remain, subject to repeated repairs. Taps in mains and service lines no longer used should be cut off and plugged at the main to prevent possible leakage between the main and the building for which the supply is no longer needed.

New Water Main Systems

In the installation of new water mains, consideration should be given to the installation of sub-meters for various areas of the premises so that individual sections of the system can be shut off and checked for leakage without disturbing other sections. In cases where sub-meters are considered too expensive, a liberal number of gate valves should be used on the laterals, and space should be provided for a portable test meter for temporary installation on each important lateral in order to permit future checks for leakage. This feature of design will avoid future expense and will make leak investigations much more convenient to handle. The advantage of the permanent sub-meters lies in the fact that frequent readings may be taken and the total compared with the master meter and with previous readings from the same sub-meter. These comparisons provide a quick method of locating the area showing unusual water consumption. At critical locations at terminals, which cannot be deprived of water, a temporary supply pipe should be installed while the permanent lines are being checked for leakage.

Sub-Surface Escape of Leakage

Considerable leakage occurs which does not appear on the ground surface. Many railway terminals have been raised with filling material. In such cases the fill is often porous and water seeps through it into ditches and tile drains without giving leak indications on the surface. In some locations sewers and drains have been laid in the same ditch with water pipes, and while this practice may reduce installation cost, it provides easy means for the invisible escape of leakage. A case of this kind is reported where long continued investigation was required to discover an underground leak. When finally located, it was found that a pit hole ¾ in. in diameter existed in a 6-in. water main, and that the water was escaping into a nearby sewer which had defective joints. The main and sewer were about two feet apart and the pressure leak had bored a well defined tunnel to the sewer without surface leak indications.

The flow in sewers should be observed in leak investigations at terminals. If approximate gaging of the flow at the outfall shows more discharge than could be expected from the water received, each sewer lateral should, in turn, be gaged at different times of peak and off-peak water discharge by the terminal. If the flow continues relatively large in one or more laterals and decreases and increases in other laterals, the leakage may be suspected to exist near the lateral with the more uniform large flow for the periods observed.

Detecting Leaks

The detection of underground leakage not appearing on the ground surface is assisted by the use of up-to-date equipment and methods. This equipment consists of ear phones, sounding rods, pipe finders and leak detectors. The methods used should start with a fairly accurate map showing the locations of the water mains and sewers at the terminal to be investigated. A calculation of the most favorable areas for hidden leakage should be made and tested. The

Tender overflow is costly and unnecessary

pipe line location should then be definitely established and marked on the surface, after which the leak detector should be placed directly over the pipe and a listening test made at intervals of 20 ft. If leakage is occurring near these listening stations the leak sounds should be audible in the earphones. If definite results are not obtained in this manner, sounding rods may be driven into the ground until they contact the pipe, and listening tests made by placing the machine on the rods. Test holes may also be excavated at a few doubtful points along the pipe line to check the correct location, and at such points the leak detector should be placed directly on the pipe for an additional test. Progress of the work should be indicated on the map referred to, and the investigation conducted in an orderly manner without duplication or indefinite movements.

The use of publicity to decrease and prevent water waste has been used extensively by the railways. The publicity is

Bridge and Building section

usually applied in a manner similar to that used in fuel saving campaigns and a certain month designated as "Water Saving Month," during which all employees are urged to save water. Posters are placed on bulletin boards and at other conspicuous locations. On these the large volume and expense of even small leaks is illustrated and set forth on a monthly and yearly basis. Water saving is discussed at meetings and employees are made aware that any savings made are highly worth while.

Publicity campaigns are responsible for considerable saving in the use of water, but, like other forms of advertising, they should be well planned and properly spaced so that the information conveyed will be interesting and the bulletins will not become commonplace. If the subject is not presented in an interesting manner, employees will drift back to the old habit of allowing water to run from the hose and faucet as the easiest way to prevent it from freezing and the most convenient method for providing cool drinking water.

Incrustation in Water Mains

The incrustation of the interior of water mains may well be considered in connection with the subject of water waste. It is true that incrustation may exist without the actual presence of leakage, but incrustation does increase the water pressure in a main under the same rate of flow, and increased pressure and water hammer increase the tendency for more and larger leaks. Incrustation increases the friction head and decreases pumping efficiency, both of which represents a decided operating loss in increased power bills and maintenance expense.

In many instances incrustation progresses in mains until the condition becomes critical and the mains cease to convey sufficient water for the users' requirements. In such cases the mains can be cleaned by mechanical or chemical methods and restored to approximately 95 per cent of their original capacity. In the meantime, the gradual increase in incrustation may have caused relatively large operating losses, as well as incidental losses and inconvenience in plant operation by restricted supply and temporary delays.

Several contracting firms, with suitable equipment and trained personnel, specialize in water main cleaning, and are prepared to do this class of work more economically than new mains can be installed. The use of this service should be considered by railways when conditions indicate that the flow in any particular main shows unusual friction loss.

Conclusions

(1) Water is an extensively used commodity by the railways and represents large-scale expenditures. The reduction of leakage and unnecessary use, even by small

percentages, should be urged on all employees. Above ground waste, such as overflowing engine tenders and water tanks, and loss through boiler feed heaters and washout tanks, is usually visible and can be corrected with a moderate amount of effort and expense.

(2) Water loss through underground leakage requires greater effort and expense. Persistence and ingenuity are required on the part of supervisors and workmen in locating and repairing many underground leaks. However, the saving in water bills will more than repay the extra effort and expense incurred in correcting underground leaks.

(3) The use of an orderly system in detecting leaks, and of modern equipment, such as leak detectors, pipe-line locaters, earphones and sounding rods, are recommended. The leak detection crew should be composed of persistent workers, and should be well instructed on how to proceed to the best advantage. It should be supplied with a fairly accurate map of the premises and pipe lines, and should mark progress on this map as the search progresses.

(4) In locations where incrustation in water mains is indicated, prompt investigation should be made to discover the actual friction loss, as this condition decreases pumping efficiency and increases power bills. Consideration should be given to cleaning the mains if the investigation indicates that the cost of this work is justified by the estimated savings.

Protection to Bridges Over Navigable Streams

Report of Committee*

IN THE early years of this country's history, transportation of commodities was largely water-borne. This started with the movement of heavy bulk materials to tidewater by river routes, and expanded to include all early-day articles of commerce that required transport. Later as rail transportation developed and was extended across water-borne transportation routes, the railroads were required to build and protect their crossings in a manner most convenient for the water routes. In many instances, the expansion of the rail lines was dependent on the exchange of traffic between the two forms of transportation. Under these circumstances the railroads benefited and therefore were instrumental in providing exchange facilities and necessary aids to water-borne traffic. Later, however, it became a contest between the two forms of transportation, one quite well established, the other just beginning.

However, from those early days until now, the bridge owner has been obligated to furnish and maintain protection for his bridge, also to provide any necessary aids to navigation. Control of these matters has always been effected by the Federal Congress, through the chief of engineers of the War Department. Instances are recorded wherein this officer in the early days personally visited the location of rail crossings over navigable waters and prescribed the form and extent of the protection and of the aids to navigation. Later official regulations controlling all phases of water-borne transportation were issued as a basis for uniform procedures, including the positioning of navigation lights on different types of protection. Conformance to these regulations has, for many years, formed a part of all construction plans, and such plans, to be legal, must carry the approval of federal and state authorities. Railway bridge and building men are familiar with these regulations, the current issue of which bears a 1947 date.

The pattern for water-borne traffic has changed tremendously during the past century, and in many instances, since the date of construction of many of the existing railroad movable bridges. Because of these

A. E. Bechtelheimer
Chairman

changing conditions many of the older bridges are no longer operated, while many others are required to accommodate water-borne traffic of a totally different character than was originally contemplated.

The change in type and character of the vessels themselves has had a tremendous effect on the situation. Formerly they were of relatively small capacity and propulsion power, generally of wood construction, and consisted principally of steamboats of the stern-wheel type, equipped as pleasure boats or as barges to handle work equipment, such as derricks and dredges, or tows of wood barges loaded with fuel, construction materials, staple commodities of various kinds, food supplies, etc. Tows were held to a minimum number of barges for safe operation and navigation was conducted with great care because a collision of this type of equipment with piers, fenders, or any obstruction was likely to result in damage to the equipment, and possible sinking and loss of vessel and cargo. The protection installed for movable bridges consisted of pile and timber construction suited to this early day inland water-borne traffic.

Present day water transports ply in coastal and intercoastal ocean waters and the waters of our inland lakes and rivers. They comprise many types of inland and ocean-going vessels including pleasure and commercial passenger vessels, trawlers and small fishing boats, cargo barges and vessels, combination passenger and cargo vessels, tankers, hopper-type barges, derricks and pile-driver barges, dump scows, dredges, tow boats, tugboats, Great Lakes freighters and car ferries, automobile-carrying river craft, naval vessels of many types, to mention a few. They transport mineral products, petroleum products, products of chemical combinations, manufactured articles, construction materials and equipment, in fact practically every article known to commerce.

In size, they range from small pleasure boats to lake freighters over 600 ft. long with beams of 67 ft. and a capacity of 18,000 tons, hopper-type coal barges having a capacity of 41 railroad cars, lake vessels accommodating 3,500 passengers and 110 automobiles, and barge tows of one to four units, each containing 7 to 8 thousand barrels of oil and other liquids—just to mention a few of the larger classes of transport. Of great significance, is the fact that most of the transports now in service are of steel construction and therefore damage to them, resulting from contact with railroad structures, is rare. Reasonably, it may be a feeling of security on the part of the operators, as to freedom from damage to water-borne transport, that results in much less precaution being taken, by operating crews, than was the case when damage to the vessels was the rule rather than the exception. Barge tows, consisting of one to twelve units, generally, are the worst offenders. When this class of transport is handled by a single tug boat, at either the front or rear end the opposite end is very difficult to control as it is easily affected by cross winds and channel currents.

Stream Characteristics

Stream characteristics at the location of many of the movable bridges are important factors in determining the extent and the kind of protection needed. They influence the safe handling of water-borne transports to a marked degree, and, in many instances, to such an extent that navigational control of a vessel is temporarily lost. The adverse stream characteristics generally encountered include: (1) velocity and direction of channel currents, (2) velocity and direction of air currents, (3) fluctuating water levels

*Chairman of this committee was A. E. Bechtelheimer, bridge engineer (retired), Chicago & North Western, Winnetka, Ill.; vice-chairmen were J. J. Winn, supervisor bridges and buildings, Boston & Maine, Boston, Mass., and N. R. Tucker, assistant division engineer, Texas & New Orleans, Lafayette, La.

Bridge and Building section

due to tides and floods, and (4) temporary fluctuations in the stream-bed level of navigable channels. Without doubt, the first two adverse conditions account for the major portion of the damage to protective installations and to the bridge structure when these installations fail due to their inadequacy or otherwise.

Tidal changes and floods, possibly to a lesser degree than the conditions just mentioned, are the source of much navigational difficulty. Tides cause reversal in the direction of stream currents, accompanied by changing cross currents. Rarely does a boat move through a movable span twice under exactly the same conditions. Generally the action of cross currents is unpredictable, particularly as to their effect on barge tows. The free end of a barge tow, whether loaded or empty, is greatly affected by cross currents, wind and wave action. There is little the tug boat can do except to maneuver one end of the tow in the best manner possible under the prevailing circumstances, in attempting to navigate through the open draw.

Due appreciation must be accorded the fact that no single type of protective installtion will suffice for all conditions. This is so because the types of transport vary so tremendously as to class and capacity, the commodities transported are so diversified and sectionalized and in general the navigational equipment and practices are so dissimilar for different classes of transport. We as railroad men, appear to be prejudiced against water-borne transportation. There is good reason why, and we are possibly disinclined to familiarize ourselves with the problems confronting operators of water-borne traffic. At locations where specific classes of traffic experience unusual navigational difficulty, construction work designed to assist in their control would be of benefit to all parties.

The protection needed to withstand the hazards of present-day water-borne traffic must conform to the conditions at each crossing, as determined by the type of movable span, the physical characteristics at the site and the character of the predominating water-borne traffic. Each location constitutes an individual problem because of the many variable factors involved. The width of the navigable channel is fixed by the type of movable span, and it remains so during the life of the bridge. Channel and weather conditions at many sites are subject to frequent and unusual changes, and in addition water-borne traffic follows unpredictable cycles of change, all of which affects the problems connected with movable bridge protection.

The types of movable spans include the swing span, the pontoon span, the bascule span, and the lift span. Protection for a swing span usually is built of wood piling and framed timber. It is designed of sufficient width to protect the sides of the span and long enough to support the ends of the span in the open position. Generally these structures are pointed at the outer ends, and beyond these pointed ends, pile dolphins, rock filled cribs, or masonry ice breakers are installed to give additional protection for the ends of the draw span. Protection for the rest piers of swing spans, and for bascule and lift spans, usually is not so extensive as that for the center pier of a swing span, and consists of fenders constructed of wood piles and framed timbers, terminated by wood pile dolphins. Sometimes wood pile dolphins are used instead of fenders.

This movable-span bridge is amply protected against damage by water-borne traffic

Several types of fender construction are used in the immediate vicinity of piers and abutments. These include the following: Waling timbers directly anchored to the channel faces of these units; waling timbers and sheeting bolted to a single row or a double row of wood piling; and steel I-beams framed to form a bumper beam that spans the full length of the pier footing. Sometimes the pile and timber fender is reinforced with small pile dolphins, driven at each end of the pier footing. Bumper beam fenders are straight, angular or circular in outline. They do not make contact with the bridge pier, but are framed to dolphins at each end. One type of dolphin consists of a cell formed by steel sheet piling, driven in a circular or other pattern to suit the location, and filled with concrete or other heavy filling. The use of concrete filling permits the encasement of the ends of vertical beams to which the bumper beam is anchored. Sometimes the bumper beam is framed to the side of the cell before the filling is placed.

In other instances, the ends of the bumper beam are framed to wood pile dolphins. These dolphins consist of five or more vertical piles and at least two batter piles, and a row of vertical piles and posts (posts rest on pier footing) provide vertical support for the bumper beam, each beam being anchored to each pile or post with a large U-bolt. Wood sheeting is spiked to the channel side of the vertical members. A large timber wale at the top of the fender extends the full length of the bumper beam and beyond to other pile dolphins which form one corner of fixed sheer booms that extend outward from the ends of the bumper beam.

An example of another type is a welded steel fender built at a swing span on the Black river at Lorain, Ohio, which consists of 14-in. steel bearing piles braced with batter piles of the same section, all driven into soft rock. This fender has a truss section along the channel side of the center pier of the swing span. It was necessary to encroach on the navigable channel to accommodate this shallow horizontal truss. The Lake Carrier's Association made no objection to this construction and the U. S. District Engineer furnished the necessary permit. River traffic past this bridge is mostly deeply-laden lake vessels loaded with iron ore and being moved up stream by one or two tugs.

Pile and timber fenders or fixed sheer booms are generally installed at one or both ends of the protection adjacent to bridge piers. Fenders consist of single, double, or triple rows of wood piles, with wale timbers and sheeting on the channel side. Spacer timbers are used between multiple rows of piles. Batter piles are used extensively, particularly where the top of the fender is 12 to 15 ft. above low water. A double row of batter piles, one at low water and the other at high water, is used in locations where water levels fluctuate widely. Fixed sheer booms consist of two rows of wood piles spaced 6 to 8 ft. between rows, and 4 ft., 6 ft. or 8 ft. apart in the rows. They are capped and braced and waling timbers are bolted to the piles on the channel face of the boom. In some instances the waling timbers are omitted and a float is provided which acts as a bumping surface that follows fluctuations in water levels. This float is a fully-enclosed timber box about 4 ft. square. It is placed on the front face of the fixed boom and is connected to a wale timber on the rear face of the boom by cross-timbers, thus forming a vertically moving unit.

Dolphins constitute an important feature of nearly all protection installations. Wood pile dolphins predominate and are designated by the number of piles in each, such as a 7-19-37-61 or 120-pile dolphins. The piles are spaced in circular rows of larger diameter at the channel bed than at the top so that, when pulled together at the top for wrapping, the batter of the piles adds stiffness to the dolphin. One or more series of cable wrappings are placed near the top after the piles are drawn together tightly. Sometimes circular steel plates or a facing of hardwood piles is provided above low water for a rubbing surface. Frequently after a dolphin has been completed, steel batter piles, generally three in number, are driven and framed to a semi-circular steel plate which is then fastened securely to the

These three representatives of the Southern Pacific came a long way to attend the meeting. They are (left to right) Franz M. Misch, gen. b. & b. supvr.; P. F. McNally, b. & b. supvr.; W. C. Harman, b. & b. supvr.

dolphin. Another way of increasing the shock resistance of a wood-pile dolphin consists of driving steel I-beam between the piles in the outside row facing river traffic. Still another type of dolphin is the steel sheet piling cell filled with concrete or other heavy material as previously mentioned. A much larger steel sheet piling cell, filled with sand, is used at the nose of the center pier protection for swing spans.

Aids to navigation comprise sight and steering aids. Sight aids, in addition to navigation lights placed for night use, consist of the painting of alternate black and white oblique strips on all channel side surfaces of protection installations that are not parallel to normal river traffic and the erection of sight poles, painted white, at the extreme outer end of the protection. This procedure has proved particularly helpful to navigators of low-height water craft. Steering aids comprise sheer fences at locations adjacent to a crossing, where the navigable channel makes an abrupt change in direction, and pile dolphins at the entrance to the throat of the customary protection installation. Sheer fences need no further mention, having been discussed previously.

A decision as to the size and location of these pile dolphins should be based upon the results of a thorough study of the physical conditions and the navigating problems at each crossing where need for them appears likely. Personnel representing the railroad, the U.S. District Engineers office and navigation interests should participate in this study and agree on the findings. In one such instance, the legal clearance at the site of a swing span is 60 ft. and the actual clearance between the faces of the protection is 64 ft. The car ferries operating at this crossing have a 54-ft. beam. It was proposed to install 2 wood pile dolphins, each one consisting of 61 piles cut off at 14 ft. above low water and 25 backing piles cut off at 2 ft. above low water. The clearance between the dolphins is to be 85 ft. and they are to be located a short distance beyond the end of the center pier protection and on the lake side of the crossing.

These pile dolphins will afford an operator of a vessel a means of lining up the boat at the approach to the bridge by holding the front end to a fixed position while shifting the rear end, with the propellers, to get the boat in a position to proceed through the open draw. In the case of a tow the pile dolphins should be located in such a manner as to line up the rear end of the tow, as the front end precedes through the open draw.

Attention is called to one instance wherein a movable swing span was declared inadequate by the secretary of war and the bridge is being reconstructed in accordance with provisions of the Truman-Hobbs act. This act provides a more equitable division of costs for changes ordered for the benefit of navigation interests.

It seems appropriate to record a few instances illustrating economic factors involved in collisions of water-borne traffic with movable bridges.

At one location in the Southwest coastal waters, a total of 33 collisions occurred in a period of five years involving expenditures amounting to approximately $110,000 to effect repairs to the bridge and its protection.

At a location on the upper Mississippi river the upstream protection was struck 9 times over a three-year period with repairs costing as much as $1,300 for each accident.

At the same location on this river a five-barge tow moving upstream struck the through truss swing span as it was being opened. The entire span was moved 32 in. upstream, breaking the center casting, buckling all roller shafts and pushing the span off the rollers. The cost of repairs amounted to $35,264, of which $21,156 represented the cost of detouring.

In 1940 a large double-track swing span over the Milwaukee river at Milwaukee, Wis., was struck by a car ferry and moved sidewise a distance of 12 in. The cost of resetting amounted to $5,000.

In 1940 a through-truss swing span over the Fox river at Green Bay, Wis., was struck head on while in the open position. The entire span, including the masonry center pier, was moved about 12 ft. downstream by sliding on the timber grillage of the pile foundation. Cost of repairs amounted to approximately $104,000, of which $30,000 represented the cost of detouring trains.

In still another instance a fully-loaded freighter struck the abutment of a bascule span in the Detroit area. This abutment formed a counter-weight pit about 30 ft. below the base of rail. The pit filled with water putting the bridge entirely out of commission due to counterweight being submerged.

The first instance cited is typical for a large number of railroad bridges over navigable streams, wherein collisions by water-borne transports result in damage to protection installations and minor damage to movable spans. The others refer to collisions wherein great damage was done. All illustrate the problems faced by railway engineering officers and bridge and building personnel. These men have no control over the causes leading to collisions however, through carefully planned protection works, they can do much to minimize the damage resulting therefrom.

Discussion

B. M. Stephens (T.&N.O.) reported that, in his territory, the district engineer's office of the U.S. Army has imposed penalties on the operators of boats for mishandling their vessels, and suggested that other roads might appeal to local authorities for similar action. L. D. Garis (C.&N.W.) asked for information on protecting cut-off piles from developing center rot. T. M. Von Sprecken (Sou.) Lee Mayfield (M.P.), and F. M. Misch, (S.P.), all responded to this inquiry, telling of substantially similar methods used on their roads. These consist in substance of the application of hot creosote to the top of the pile, the creosote being retained on the pile by means of a dam of clay or other material while soaking in. In addition, Mr. Misch told of the practice of capping the pile top with a galvanized metal cap after it had been covered with hot asphalt or tar.

H. S. Loeffler (G.N.) told of a substitute for pile-cluster dolphins, which is in use at an ore dock on his road. In this construction, a number of used automobile tires are threaded on a 12-ft. length of 14-in. by 14-in. timber. The timber is then mounted upright and secured to the outer end of the dock by means of cables.

Mr. Garis then asked for information regarding the economical size of timber for use as fender facing in view of today's material prices. G. H. Perry (P.R.R.) said that if the vessels using the facility are of large size, the fenders will wear rapidly, regardless of size. He then told of a method of extending piles by caping them with lengths of pipe which are then filled with concrete and wrapped with steel cable. This method, he said, is highly satisfactory.

Recent Developments in Fuel Oil Storage and Servicing Facilities

Report of Committee*

IT WAS reported to this association in 1946 that there had been a steady increase in the use of Diesel locomotives since the first streamlined Diesel-drawn passenger train went into regular service in 1934. In the two years since that report was made the total number of Diesel locomotives in service on the railways of the United States has increased 68 per cent and some individual classes have more than doubled in number. The accompanying table shows the changes that have occurred.

Diesel Locomotives in Service

	February 1, 1946		May 1, 1948	
	Loco.	*Units*	*Loco.*	*Units*
Passenger	213	378	628	1,105
Freight	318	1,016	870	2,236
Pass. or Freight	89	126	65	101
Switching	2,373	2,383	3,069	3,087
Total	2,993	3,903	4,652	6,529

As can be seen from the table, the greatest percentage increase has occurred in road locomotives, both passenger and freight. This precipitous rise in the number of Diesel road locomotives has brought about a serious problem in the storage and handling of fuel oil. When the rapid increase in the number of locomotives is considered in the light of threatened, if not actual, shortages of fuel oil, there will be little doubt as to the seriousness of the problem of providing adequate storage capacities and facilities. Few railway planners could possibly foresee increasing requirements. Those that anticipated the expanding use of fuel oil relied on adequate distribution methods to provide for their needs. Recent experiences have shown that such reliance has not always been justified.

A typical example of how the need for storage facilities has expanded is provided by a relatively large Class I railroad which, only eight years ago, had only six two-unit Diesel locomotives. To service these locomotievs six fuel-oil stations were installed, each embodying two storage tanks of 20,000 gal. capacity apiece. A motor-operated pump, having a capacity of 100 g.p.m., was used for transferring oil from tank cars to the storage tanks and from the latter to the locomotive fuel tanks. Emphasis was placed on the cleanliness of the oil as it was delivered to the locomotives. The precautions taken to insure that cleanliness included nothing more than screens located at both inlets in the top of each tank and in the outlet at the bottom of the tank, and a three-inch strainer or filter of the basket type installed in the discharge line adjacent to the pump. In addition, the hose nozzle, when not in use, was closed with a cap to prevent the entrance of foreign matter.

*Chairman of this committee was H. E. Michael, associate editor, *Railway Engineering & Maintenance*, Chicago; vice-chairmen were W. D. Gibson, water service engineer, Chicago, Burlington & Quincy, Chicago, and R. L. Fox, division engineer, Southern, Alexandria, Va.

H. E. Michael
Chairman

Consider the situation on that railway today. It now has 71 Diesel passenger units, 148 freight units, and 108 switchers. An additional 85 units either have been recently received or are on order.

Storage capacity has grown from a total of 120,000 gal. in 1940 to 2,100,000 gal. at 25 locations in 1946. At that time the total monthly consumption approximated 4,971,000 gal. Thus, since the storage capacity was a little less than two weeks' requirements, a burden was placed on the existing facilities.

New storage tanks are now being built at 18 different locations, varying in size from 20,000 gal. to 1,000,000 gal. Upon completion the oil storage will range from the minimum of 8,000 gal. to 2,030,000 gal. at the point of largest storage. There will then be a combined capacity at 43 locations of 7,160,000 gal., which will supply almost two months' requirements at the present rate of use.

Such rapid expansion as this, paralleled on many other roads, has brought with it many different schemes suited to the individual needs and standards of each road or sometimes to each location. However, out of the many new installations being made throughout the country, a general plan is gradually crystallizing which represents a composite of the ideas of the many designers.

Facilities Generally Included

In this plan the total capacity of bulk storage to be provided is largely determined by consumption and space requirements. Usually it varies between the minimum of a week's supply to the maximum of three months' requirements. The total storage is seldom carried in a single tank unless the quantity is small. Multiple tanks provide a more feasible and uniform supply without conflicting with pumping operations during periods when cleaning and maintenance work is being carried out. The minimum size of individual tanks is usually 10,000 gal. The maximum size is an individual problem dependent on local conditions, and is steadily going up.

Tanks may be located above or below ground, the governing factors generally being local fire codes and available space. Where possible, above-ground tanks are preferred for the following reasons: (1) Accessibility for inspection and repair of the exteriors; (2) accessibility for draining condensate and sludge from the bottoms of the tanks; and (3) exclusion of water that may otherwise enter through undiscovered underground leaks.

Above-ground tanks, up to 25,000 gal. in capacity, are usually supported horizontally in concrete cradles. Those tanks having capacities in excess of 25,000 gal. are of the vertical type supported on a foundation of crushed rock or sand, usually mixed with oil and retained around the periphery of the tank by a small concrete wall.

Above-ground tanks are made to conform in strength to the American-Petroleum-Institute (A.P.I.) specifications, and to conform in most other respects to the requirements of local fire codes or, in their absence, to the requirements of the National Board of Fire Underwriters. Dikes are always specified by these latter authorities and vary in retention volume from 100 to 150 per cent of the tank capacity. The construction of the dike may vary from economical earth barriers to expensive concrete retaining walls.

The manner of transferring the oil from tank cars to storage tanks varies on individual roads. Most of them prefer, however, to pump the oil through the domes of the tank cars for two reasons: (1) Sediment collects in the bottoms of the cars and drains off with the oil when it is transferred through the bottom openings; and (2) the spillage that results from making connections to the tank bottom is wasteful and creates a fire hazard.

Unloading racks in most cases are similar to those used for many years by oil companies except the few instances where aluminum drop pipes have been used for lightness and to reduce the hazard of sparks made by iron pipes striking the tank cars. The average arrangement of pumping and servicing facilities can be shown best by giving a brief description of two recently completed installations, one typical of the methods employed in warm territories and the other of those used in cold areas.

Typical Southern Installation

In the southern method, oil cars are unloaded at a five-position dome-unloading station. The transfer of oil to the storage tanks, which have a combined capacity of 120,000 gal., is effected by a 200-g.p.m. rotary pump, housed in a 16-ft. by 16-ft. con-

crete-block pumphouse. A similar pump, also located in the pumphouse, transfers oil from the main storage tanks to two 5,000-gal. delivery tanks located at the main-track fuel stations.

When the liquid level drops in either of the delivery tanks while a locomotive is being fueled, a float switch starts the pump at the main pumphouse to transfer oil from storage. When one tank becomes full, a float valve prevents it from overflowing while the other is being filled. Pumping continues until both tanks are full.

The piping in the pumphouse is arranged in such a manner that, if necessary, each pump may be used interchangeably. For each pump there is a pipe-line strainer, an air-release tank and an expendable cartridge filter. Pressure valves are installed on each side of the filter so that the progressive clogging of the filters may be watched and the cartridges changed accordingly.

In being transferred from the unloading point to the pumphouse, the fuel oil passes through a 6-in. wrought-iron line, laid in a concrete trench. Elsewhere the line is overhead except where it extends under the tracks, enclosed in a 14-in cast iron pipe conduit, or where it by-passes the station area, being carried underground in a 15-in. insulating conduit. The overhead sections of the line are carried on rollers attached to steel-pipe brackets welded to posts made of scrap rail set in concrete.

Two refueling stations—one for trains in each direction—are so located that three-unit locomotives can be serviced while the station stop is made. Each fueling station consists of a concrete platform 10 ft. wide and 220 ft. long, along the center of which five fuel-oil columns are located so as to serve the fuel tanks of various locomotives. Water servicing facilities are also provided.

Oil is pumped from the 5,000-gal. delivery tanks by a 500-g.p.m. pump driven by a 10-hp. electric motor which is housed in a 7-ft. by 7-ft. concrete-block pumphouse. The operation of the pump is remotely controlled from the fueling platform by a push button.

The fuel-oil columns, of the swing-pipe or "boom" type, are made of 4-in. wrought-iron pipe and rise to a height of 9 ft. 11 in. above the platform. An 8-ft length of 2½-in. hose is attached to the end of the boom by a single-swing elbow. At the end of each hose is a 2½-in. fuel nozzle, which may be opened and closed quickly by hand, and a quick-assembly connection for attaching the hose to the fuel tanks.

The precipitous rise in number of Diesels poses serious problems in fuel oil storage

The northern installation is typical of several that have been constructed recently where extremely cold weather can be expected. These particular fueling stations are located so that only trains in one direction are fueled at each station, and individual storage capacity is thus reduced below the average.

One or two tanks, each with a capacity of 25,000 gal., are provided at each station. They may be above or below ground, depending on local conditions. The above-ground tanks are protected with two-inch secondhand boiler insulation which is covered with sheet steel from old locomotives and painted with aluminum paint. The tanks rest on steel saddles supported on concrete pedestals. The tanks tip slightly toward the end having an outlet drain. Steam pipe coils are provided within the tank to keep the oil warm enough to be pumped and filtered easily. Steam in the coils is regulated by a thermostatic valve. This conforms to the recommendations of the oil industry that provisions be made to heat fuel oil in territories where the temperature may fall below 0 deg. F. The tanks are provided with gauges, manholes, vents and inside ladders and are designed to conform to the specifications of underwriters whose label they bear. Each tank is grounded to permanent moisture and is diked.

To unload a tank car at such installations it is emptied through the dome at an unloading rack of which the horizontal and downspout portions are made of light 4-in. tubing to facilitate handling them in and out of the car. The principal equipment is installed in an insulated, prefabricated, steel building, which is heated by steam pipe coils.

The piping arrangement in the pumphouse is such that the oil coming from the tank car first passes through a strainer then through either of two 250 g.p.m. rotary pumps connected in parallel, thence through an air release tank, two filters, and a meter to the storage tank. In pumping oil from storage to a locomotive, both pumps are used. In this operation the oil from the pumps again goes through the same air release tank, and two filters, but through two different meters to three platform delivery hose pits. It has been found more economical to provide the two 3-in. meters in the fueling line than to install a single meter capable of registering 500 g.p.m.

The platform hose pits, placed to conform to fueling inlets on locomotives, are made of concrete, with hinged, steel-plate covers. Each pit has steam coils to keep the oil lines warm in winter and each contains a reel on which 25 ft. of 2½-in. hose is wound. These reels are operated by brake wheel cranks and a pinion gear shaft. The cranks are hung in the pits when not in use. The end of each hose hangs on a hook just inside its pit cover when not in use. Remote control push buttons are provided at the oil delivery pits to start and stop the pumps. Special lighting facilities are installed for night operation. All underground pipe lines are coated with asphalt and burlap.

Fire Protection

Neither of these two examples includes any fire protection facilities other than the grounding of storage tanks. Fire protection systems constitute one of the most recent and most rapidly expanding new developments in fuel-oil installations. Such protection may begin by bonding and grounding the track on which the tank cars are unloaded. Most but not all roads do this. Those that do not, justify their actions by the fact that Diesel fuel oil is a class III liquid, having a flash point higher than 70 deg. F. Under most codes, tracks are not required to be bonded where only class III liquids are unloaded. Where tracks are bonded, it is usual that storage tanks and pipe lines are grounded to "permanent moisture." Practically all tanks are provided with screened vents approved by fire underwriters.

There is a growing tendency among railways to provide additional fire-fighting apparatus to safeguard adjacent property against the spread of any fire which may start in fuel-oil-storage areas. In some installations dry-pipe foam systems are installed with small fire houses located some distance from the danger area. At other places automatic fog-nozzle systems have been installed where adequate water pressure is available. Often both of these systems are combined.

All insurance-company engineers insist that there are fire hazards in varying degree in connection with the handling of Diesel fuel oil from the time it is received on the unloading track until it is delivered into the tanks of locomotives. The chief engineer of one insurance company doing a large railway business was asked for suggestions as to how fuel-oil facilities should be protected. He said that, first of all, "no-smoking" and "no-open-flame" signs should be posted.

In addition he offered the following suggestions: "Fire protection for such facilities should consist of a conveniently located 20-lb. carbon-dioxide extinguisher, or an equivalent size of an approved dry-powder type for the smaller installations, and additional protection where the installations are large enough to justify it.

"A few construction and installation features have a direct bearing on the hazard of fire. A fuel-oil pumphouse should be of fire-resistive construction and be provided with explosion-proof electrical installations. Care should be taken to see that a check valve is installed in the pipe between the unloading rack and the first valve at the pump, and another check valve installed between the filter, or the equalizing pressure tank, and the storage facilities. These valves are necessary to prevent a back-flow of oil through the pumps in case the manually-operated valves are accidentally left open.

"In some cases gasoline-driven standby engines are provided for service in case of power failure and the resultant immobility of the electric-driven, fuel-oil pumps. Where such gasoline engines are provided, they should be installed in a separate room cut off from the fuel-oil pumphouse proper by a fire wall. The shaft from the gasoline engine to the fuel-oil pump, which of necessity must run through the fire wall, should be equipped with a stuffing box.

"Diesel fuel-oil storage tanks of 100,000 gal. or larger capacity should be installed where they will not expose other property and should be diked separately. A drain pipe having a valve should be placed in the dike so that any water accumulations in the enclosed space my be drained easily.

"An automatic built-in foam-generating system should be installed as fire protection at each Diesel fuel-oil storage tank having a capacity of 100,000 gal. or more. When such tanks or other facilities are located where yard hydrants are available at which pressures above 45 lb. at the nozzle can be secured, each hose house should be equipped with an approved fog nozzle.

"Diesel fuel-oil piping should be welded at all connections possible. The trend is to install such pipes on permanent non-combustible supports above ground so that in case any leak develops it can be quickly detected. In some of the earlier piping installations screw joints were used, and in a few cases serious leaks developed even though the joints were coated with a mixture of Venice turpentine, litharge and shellac, or a mixture of litharge and glycerine. It has been found generally that Diesel fuel oil will seep through any connection except a welded joint."

Probably the most recent development in Diesel fuel-oil storage-tank protection is the automatic fog and fog-foam combination. In this system hydraulic arms are arranged so as to move out over the tank when the temperature reaches a predetermined figure. At the outer end of the arm a rotary fog nozzle is attached which will deliver 200-g.p.m. for a 40-ft. diameter coverage. The valve mechanism and water-flow control is located below frost line in a closed galvanized case. Full provision for drainage is provided. For tanks more than 40-ft. in diameter a manually-operated foam system is usually added. In this system, water fog first cools the material and then mechanical foam is used through the same nozzles that were utilized for dispensing the fog.

One road, recognizing the hazard of fire caused by oil being spilled at main track fueling stations, has installed a method of collecting the spilled oil. This consists of a concrete apron under the track, and a drainage ditch along one side to collect the oil and carry it to a catch basin. From the catch basin the oil flows to a settling basin and thence to a proprietary interceptor and separator. From this device the water is drained into a sewer and the oil is pumped into drums. The installations now in service are rated at 200 g.p.m. but will take an occasional flow of 1000 g.p.m. Such a system, complete with pumps, valves, electric panel-board and other fittings is said to cost about $2,500.

While railway fuel-oil storage facilities have been expanding rapidly, the oil companies have been continuing their research and experiments to improve their facilities and those of their customers. One of the most significant developments of their research work has been that pertaining to corrosion of oil facilities, particularly tanks.

The replacement or reconditioning of oil-storage tank bottoms due to external corrosion has been an expensive maintenance item to the oil industry. The annual loss, from this source, to the nation's pipe lines and storage tanks has been estimated at $200,000,000.

After a study of various methods of minimizing this loss, several oil companies have resorted to the universal use of cathodic protection. In one installation a number of 20,000-bbl. tanks was protected at a cost of about $300 each. Around each tank 12 holes 7 feet deep were drilled by hand augers about 2½ ft. from the tank and about 17½ ft. apart. Magnesium anodes weighing 60 lb. apiece were placed in the holes and surrounded with a wet backfill consisting of 75 per cent bentonite and 25 per cent gypsum. The anode leads were bolted to the angle irons at the base of the tanks. Electrical measurements which have been taken indicate that such a system offers adequate corrosion protection, and it is estimated that the anodes will last for 15 years.

Another development of significance to

Bridge and Building **section**

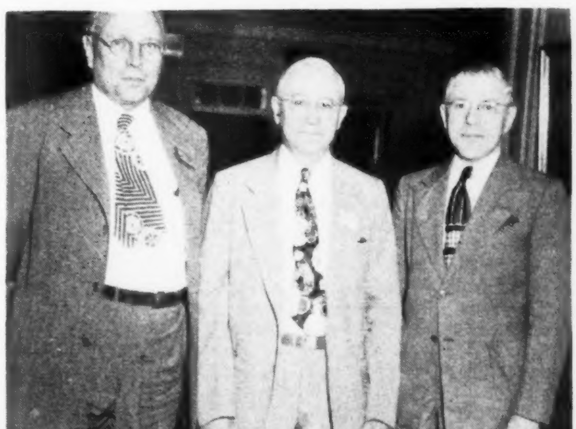
the railway users of fuel oil is a method of solving the sludge problem in oil storage tanks. According to good authority, such sludge is a water-in-oil emulsion in which minute globules of water are completely covered with oil. Sludge forms from the condensation of moisture on the inside of the tanks and then causes a great deal of trouble in filters, and, if not removed, in the injector nozzles of Diesel engines.

One of the reported solutions to this problem is to pour certain chemical additives into the oil storage tanks in small quantities. These additives are said to dissolve the sludge already present in the tank and equipment and to prevent new deposits. Its proponents insist that these chemicals keep the entire system clean, from tank top to injector nozzles, and eliminate the job of cleaning tanks frequently. If such be true, the use of such chemical additives may well be considered by railway users of fuel oil. This is particularly pertinent in those instances where storage capacities are large and oil is stored for long periods.

Discussion

President Hancock inquired if any roads were providing drainage through the dikes around storage tanks to carry off storm water. W. D. Gibson (C.B.&Q.) replied that this practice is contrary to law in many states. H. B. Christianson (C.M.St.P.&P.), in speaking of the importance of collecting spilled oil, told of the experience of one road, on which, over a period of years, a large quantity of oil spilled at a fueling point had saturated the surrounding ground. When pumped out, the accumulated oil totaled more than 9,000 gal. E. H. Barnhart (B.&O.) told of a similar experience in which spilled oil found its way into a city sewage system, and, through it, to a disposal plant, with harmful effects on the latter.

L. C. Winkelhaus (C.&N.W.) questioned the practice, at fueling stations, of winding



The Baltimore & Ohio was represented by—Left to right—R. W. Gilmore, gen. br. insp.; E. H. Barnhart, div. engr. (President-Elect, Bridge & Building Asso.); Otis G. Wilbur, asst. engr. bldgs.

hose lines on reels when they are full of oil. Chairman Michael and others responded that this practice is followed at a number of locations with success. Another question by Mr. Winkelhaus dealt with the need for heating fuel oil during cold weather. Mr. Michael, in reply, stated that this oil, as furnished, has a pour point of 0 deg. F. and that failure to heat it may result in harmful effects to pumps and filters and to locomotives, possibly resulting in road failures.

Good Housekeeping to Promote Safety and Fire Prevention

Report of Committee*

DURING the first eleven months of 1947 accidents resulted in injuries (with more than three days disability) to 32,642 employees of our nation's railroads, and death to a total of 632. Although this is a reduction of 7 per cent in injuries and a 4 per cent decrease in deaths compared with those in 1946, the figures are appalling and are an indication that accident prevention programs are still in their infancy on the railroads.

What corrective measures must be taken before we can erase these figures from the records and stop the suffering and loss of life involved? What are the costs of these accidents to the railroads and employees in medical expenses, wage losses, increased insurance rates, and so-called indirect losses? There are many answers to these questions, but one of the most important—in preventing accidents and their resulting costs—is "good housekeeping."

For the purpose of this report, good housekeeping may be defined as cleanliness, neatness and order as applied to buildings, locker rooms, shops and field jobs, so as to reduce or eliminate the hazard of personal injury, property damage or fire. Good housekeeping is, in itself, largely a matter of attention to details and alertness to detect potential hazards. The best efforts of the numerically few persons assigned directly to this work are much less effective than a proper interest on the part of supervisors, foremen and other employees.

A Fundamental Requisite

A fundamental requisite of any successful safety and fire prevention program is good housekeeping. Primarily, this is management's problem, for good housekeeping and orderliness are fundamentals of good management. Employees, however, must also do their part toward keeping their work places clean and orderly.

First, let us consider this matter as it applies to operations under the direct control of the bridge and building department, and then as it relates to other departments, bridge and building operations being sharply divided between those in their own shops, locker rooms and boarding car outfits, and those in the field or in buildings used by other departments.

In many instances, railway facilities, including buildings, are antiquated. That such is the case, with its influence on accident hazards, is beyond the consideration of this report. So far as this committee is concerned, we must consider that it is necessary largely to do the best we can with what we have, rather than recommend large expenditures for replacement. We must consider what we, ourselves, can do to promote safe conditions, without capital expenditures or special authorizations.

H. E. Skinner
Chairman

Immediate action on the part of the supervisor, with the means available at the time and place, shows his men that he is actively interested in their welfare. For example, tool racks can be improvised during inclement weather when the men would otherwise be idle. Steel lockers are inexpensive and can generally be obtained if the matter is properly presented to those in authority. Metal bins for oily waste, and bins for the collection of chips, shavings and sawdust in carpenter shops, can be improvised at little expense and with great benefit in preventing accidents and fires.

Storage of Materials

A frequently neglected feature is the proper storage of material and supplies. This is a source not only of accidents and fires, but of large wastages of material. Men working about or over poorly stacked material are not only hazarding injury but are wasting time needed for productive work. The provision of racks and bins for all material not only puts this material out of the way, so that injuries are avoided, but also makes it possible to get out material for a job with much less hazard of injury and with a large saving of time.

An added benefit, which should be attractive to management, is that, with properly arranged and marked racks and bins, a foreman can, with little effort, insure that he will always have on hand the material necessary for his work. At the same time it permits the supervisor and representative of the stores department to make sure that excessive amounts of material are not kept on hand, with consequent economic loss.

In field operations, the job of housekeeping should start as soon as the men arrive at the scene of their work. Bridge and building material should be kept neatly piled and sorted, both on the ground and in work cars. Methods must be worked out for the proper handling, placing, piling and storage of materials, with careful consideration to the volume and location. Men are constantly being injured by tripping over loose objects or slipping on greasy or dirty floors; by falling material and tools not properly placed; by running against poorly piled materials; and by hundreds of hidden causes which are the result of poor housekeeping.

Within and around buildings used by other departments, the responsibility of the bridge and building department is ordinarily confined to the maintenance of existing facilities and the construction of new facilities under budget authority. However, a cooperative attitude on the part of B. & B. employees will greatly assist those responsible for operation of the facility. Our assistance in the good housekeeping efforts of other departments not only helps to reduce loss and expense to the railroad as a whole, but frequently reduces demands on our department for repairs or construction.

To this point in our report we have dealt with the subject of good housekeeping and its relationship to the safety of the individual. This subject, however, has another relationship, which is equally important to the railroads and their employees, and that is the matter of fire prevention. Fire prevention involves not only protection from injuries to the employee, but protection for their places of work.

During 1947, 249 railroads in the United States and Canada, representing 266,000 mi. of first main tracks, reported the following number of fires and their causes and losses:

529 fires caused by sparks, hot coals or burning oil drip, with losses of	$313,693
87 fires cause by brake shoe sparks, with losses of	71,951
278 fires caused by coal or wood stoves, with losses of	216,706
419 fires caused by smoking and matches with losses of	382,937
211 spontaneous fires, with losses of	198,577

*Chairman of this committee was H. E. Skinner, supervisor scales and work equipment, Elgin, Joliet & Eastern, East Joliet, Ill.; vice-chairmen were R. F. Spofford, assistant division engineer, Boston & Maine, Dover, N.H., and E. H. Blewer, supervisor safety engineer, New York Central, New York.

How many injuries and how much damage was caused by all fires, and how many fires were the result of poor housekeeping, we do not know—but we do know that the maintenance of a high standard of cleanliness and order is perhaps the most important single element in fire prevention. Rubbish may not be the cause of a fire itself, but it supplies the fuel for a carelessly discarded match, cigarette or stray spark. Even when fire is attributed to some other specific cause, poor housekeeping provides extra fuel for the blaze and adds to the damage.

Locker Maintenance

The lack of cleanliness in lockers, and their general use as a storeroom for waste material, are fire hazards. This is particularly true when such lockers include waste, oily rags and clothes, or clothes smeared with paint. The use of cotton waste is very common, and the practice of storing small quantities, even though clean, in cupboards and lockers, is a fire hazard, as inevitably more or less dirty waste will be mixed with it. Where not removed from the building immediately, waste paper and other waste materials must be kept in fire-resistant containers. Any source of heat is a potential fire hazard to be guarded against by preventing adjacent combustible materials from reaching dangerous temperatures.

In many cases lockers are old and built of combustible material. If possible these lockers should be replaced with steel lockers. The tops of lockers should be slanted to prevent piling material on them. Lockers should fit tight to the floor so that material cannot be put under them. If new lockers cannot be obtained, there are almost always ways to improve existing conditions with slight expense. The provision of tables for men to eat their lunch, and properly located trash cans, will help in preventing accumulations of paper, and particularly of food particles that attract vermin. The most important requirement for locker rooms is to place definite responsibility for its condition on one individual, and give him the necessary authority to see that the room is properly used.

Housekeeping About Exteriors

Most of us are familiar with the requirements of good housekeeping within buildings and, perhaps, in stressing the necessity for cleanliness within, we lose sight of the requirements of good housekeeping about the exterior and surroundings, which are equally important. Water tanks, stock yards, trestles, ice houses, snow sheds, team tracks and isolated buildings are often neglected when it comes to good housekeeping. The decks of bridges are often sadly neglected. Waste rags, paper and other debris often become lodged in them and, when dry, are vulnerable to ignition from engine sparks or hot coals and burning oil drip. Dry vegetation is extremely hazardous, and housekeeping should include the removal of it from around and underneath combustible structures, including bridges and pole lines. Cleaning up of the site after completing a job is an important feature frequently neglected. Accumulations of scrap materials, even if not a hazard to the crew on the job, are a definite hazard of fire or accident to others.

Bad housekeeping promotes spontaneous combustion when substances subject to rapid oxidation are involved. Every combustible substance will ignite and burn if raised to a suitable temperature in the presence of air. Fire prevention practice starts, therefore, with the basic principle of preventing combustibles from reaching ignition temperatures—and by good housekeeping we eliminate these hazards.

Awards Recommended

The element of competition is frequently of great benefit when it is desired to engage the interest of employees in achieving a goal. This committee therefore, recommends that consideration be given to the making of awards for good housekeeping as applied to the physical property within the territory of each foreman or supervisor. Such a system would, however, be so varied from railroad to railroad, or from department to department, as to make it difficult to set up any standard form. If undertaken, it should be with the understanding that considerable effort will be required of supervisory officers, and that a definite attitude favorable to correcting and improving conditions will be assumed on the part of the management.

Without such an elaborate set up, benefits can be obtained only by special interest on the part of all supervisory officers. They should mete out guidance, suggestions and commendation to those doing exemplary work, and sharp discipline for those foremen and men who will not cooperate.

Planned Program Necessary

Good housekeeping is more than cleanliness; it is cleanliness and order. It cannot be had by an occasional grand clean-up, but must involve a planned program for each day's work. Every employee must do his part, as one poor housekeeper in an organization not only leaves much disorder in his path, but sets an example, disruptive to the morale of all.

A clean shop, office, warehouse, yard or right-of-way does more than merely impress the public; it prevents accidents and saves lives. To maintain such conditions requires the constant vigilance of all.

Discussion

President Hancock started the discussion by requesting information relative to the issuance of awards as incentives for good performance. G. S. Crites (B.&O. retired) outlined a practice formerly used on the Southern Pacific wherein medals were awarded in connection with annual inspections of the various supervisory territories of the road. Mr. Crites also emphasized the great loss suffered by the railroads because of the careless habits of smokers.

F. M. Misch (S.P.) advised that awards were no longer made on his road, but said that much was accomplished by personal commendations of supervisory officers for meritorious work. He also stated that the site at each job should be cleaned up daily instead of waiting until the work is completed.

L. R. Morgan (N.Y.C.) commenting on fire protection for camp cars, indicated that calcium chloride, carbon tetrachloride and carbon dioxide fire extinguishers were in general use. He said that the 5-gal. pump-type carbon tetrachloride extinguisher is well suited for use in kitchen cars where oil and grease fires predominate. This type generally is also easier to recharge, he said.

C. E. Gracelon (Bang. & Aroos.) commented on the valuable first-hand information he received by accompanying the fire insurance inspector on a trip over his road.

A high standard of order and cleanliness is an important element in fire prevention

Housing Bridge and Building Employees

Report of Committee*

IT IS evident that as railway bridge and building programs expand to meet changing and growing needs on the railroads, we must modernize the methods of housing bridge and building employees. The day of the obsolete and poorly furnished and maintained bunk cars is nearly over. The demands of progress make this necessary for many reasons.

Camp Cars

Camp cars for B. & B. and other road forces vary greatly in design. The availability of cars not required for revenue service determines to a large extent the type of cars used. Obsolete coaches, box cars, troop sleepers and all kinds of cars which can be converted to camp cars have been and are being used. Some roads have comprehensive programs for camp-car renewals and, of course, the best that the appropriations allow are being converted. Standardization of design to meet present-day requirements is recommended by the committee.

The usual cars in a boarding or camp-car outfit include sleeping, kitchen, diner, recreation, tool and material cars. In sleeping cars, it is considered good practice to separate individual bunks with lockers to provide adequate fresh air for sleeping men. Arrangements vary, but are made with the view of meeting practical requirements for comfort. When the size of the force permits, lobby space with chairs, tables, etc., can be provided in a portion of the sleeping cars. Where larger forces are involved, it is considered good practice to have separate recreation or lobby cars, furnished in accordance with the requirements of the force.

The lobby and wash car, if separate, should be placed next to the dining car and equipped with individual lockers. The washing and bathing facilities in this car should meet the requirements of those sanitation rules applicable.

The kitchen and dining car for forces of ordinary size should have a small bunk room off the kitchen for a cook's quarters, equipped with his bunk and a cook's small writing desk and chair. This is desirable to prevent disturbing the cook or other men, whose sleeping hours are at different times.

Sanitation

Sanitation measures must meet all state and federal laws that apply. In sleeping cars, the number of bunks should be based on allowing 40 to 50 sq. ft. per man, figured on total floor space. Floors and walls should be of such design as to permit easy cleaning, and light colors for walls and ceilings

W. W. Caines
Chairman

are recommended for light and decorative purposes.

Coal or oil-fired hot water heaters are recommended for uniform heating. Windows should be located to provide adequate ventilation and all doors and windows should be screened. It is desirable to wire living and dining cars for electric lights, the power to be furnished from either stationary or portable sources. Bathing and washing facilities should be provided with adequate water storage tanks, to be filled by a hand or engine-operated pump. Lockers of satisfactory size should be provided.

Drinking Water

Drinking water coolers meeting Public Health Service requirements are recommended. Portable privies or chemical toilets, properly constructed and maintained, will comply with Public Health Service regulations.

Kitchen and dining car design should, in general, conform to the design of bunk cars with respect to floors, walls, ceiling, screening and lighting. Ventilation over stoves should consist of metal hoods and exhaust fans. Tables and shelves should have smooth, water-resistant surfaces, easily cleaned. Storage facilities for packaged and non-perishable foods should provide protection from insects, dust and other contaminating influences. Refrigerators of adequate size and design to store perishable foods should be provided. Sinks for dishwashing, constructed of non-rusting materials, and water heating equipment, are necessary.

Sanitation Rules

Sanitation rules for camp cars must provide for responsibility as to enforcement, and should be uniform for all types of forces. The organization should provide adequate personnel to operate and maintain properly the sanitary equipment furnished. Requirements for cleaning, heating, cooking, waste disposal, insect control, drinking water, toilets, etc., should be definite and clear, and supervising officers should see that they are followed.

The foregoing recommendations governing sanitation conform in general to tentative recommendations of the American Railway Engineering Association.

Handling of Meals

The cooks usually work the same hours as the men in the force, plus additional time necessary before meals to prepare the food, and after meals to clean up the kitchen and dishes, to be ready for the next meal. On some roads cooks are paid one or two hours additional time at pro-rata or time and one-half for the extra time worked.

In large forces very few cooks pay board. In small forces they usually pay the same board as those in the force are required to pay. In some gangs, the cooks pay for one meal a day. This matter is usually optional with the force personnel and no set rules govern.

Board arrangements are made according to the method adopted by the force for paying for their meals. On most roads the meals are pro-rated to each man on the basis of total meals in the cars between pay days. Other roads have a so-called "jack-pot", where each man puts a certain amount of his pay in the jack-pot each pay day. Shopping for groceries is then carried out according to the amount of money available.

Some roads have considerable difficulty in obtaining and keeping good cooks for their road forces. The lack of a good cook can do much to lower the morale and efficiency of a force. Some better system for training and holding cooks is very desirable, and improved collaboration between B. & B. and personnel departments might improve this weak point, which is so vital to the maintenance of good road organizations.

Protection of Camp Cars

There are several different ways of protecting camp cars, set off along line, against train accidents. One method is to provide so-called bunk-car discs which are attached to the leading switch on the siding where cars are stored. In addition to the discs on the switch, the first car should be protected with amber lights, placed on the end of the car in the same position as on a caboose or end of train.

When occupied cars are set on a siding, the switches at each end should be spiked to prevent any possibility of a train striking the cars. Another method consists of using special derails, equipped with disc and light, and locked to the outside rail. This type derail cannot be removed except by permission of the foreman in charge

*Chairman of this committee was W. W. Caines, assistant supervisor, bridges and buildings, Chesapeake & Ohio, Huntington, W. Va.; vice-chairmen were J. J. Healey, assistant supervisor, bridges and buildings, Boston & Maine, Boston, Mass., and H. A. Hunt, division engineer, Texas & New Orleans, El Paso, Tex.

of the cars. When the size of the job to be done warrants, and it is feasible to do so, camp cars should be set on temporary dead track disconnected from the operating track.

Transportation of Gangs

On most roads B. & B. men are usually transported by motor car to the site of work. If a long-distance travel is required, either for emergency or short jobs, transportation is usually by truck or work train. In some cases, regular passenger trains are used when the leaving and arriving times of such trains do not entail too much travel time and overtime.

Many man-hours are lost waiting for clear track when transportation is by motor car, especially in long blocks where signals must be clear before the gang is allowed to operate the car. This lost time could be avoided where railroads parallel improved county, state or federal highways, by the use of trucks. Materials can also be transported more economically in trucks and with less chance of interfering with train operation.

Fire Protection

Every bunk, lobby and dining car should be equipped with standard fire extinguishers placed inside the entrance door. Kitchen and tool cars should also be equipped with carbon tetrachloride, soda and acid or other approved types of fire extinguishers. Rules for fire prevention should be posted in all camp cars and supervision exercised to enforce them.

When camp cars are wired for electricity, and it is practical, gangs are provided with electric lights. Some camp car outfits are equipped with portable generators for lighting. When electricity is not available, oil lamps of approved design are used.

On some roads the maintenance of the inside of cars is taken care of by the bridge and building forces, and body and running-gear repairs are made by the local car department. On other roads, when the cars get to a point of heavy repairs, they are sent to the car shops for general repairs to the body and running gear. The maintenance of good paint standards in camp cars is very essential for good housekeeping and good morale among the forces.

Bunk Houses—Permanent

Bunk houses for bridge and building employees should be 24 ft. wide and 60 to 80 ft. long, with a hall running through the center for about 40 ft. and rooms to each side for two men. A recreation room should come next, with toilet, showers and wash room leading off from the recreation room. The dining room and kitchen should be on the end, and a porch should run the full length of the building on one side. This arrangement will take care of 12 to 16 men. The ideal arrangement is then completed by having a centrally located heating plant, large enough to take care of the necessary hot water for kitchen and showers, unless a separate unit is desired in the shower room for hot water.

Permanent camps are generally more satisfactory throughout the course of the year. The men usually are better satisfied as to the amount of room available in these camps. The camp is generally located more advantageously for obtaining food supplies, electric current and off-hour recreation for the men. Transportation of the men to and from jobs is usually provided by trucks or motor cars. This item is of great importance in selecting the locations of permanent camps.

The type of camp to be used will probably vary according to the climate in which it is situated. The permanent type is more desirable where temperatures are extreme, as better protection can be provided in this type against wide ranges of temperature by means of insulation, better heating facilities, etc.

Bunk Houses—Portable

Bunk houses of movable size, or of prefabricated design which can be erected and "knocked-down" easily, are advantageous for portable camps. Trailers have been used on some roads. A fair size portable camp outfit can house 40 to 50 men.

The kitchen and the dining room should be separate from the bunk houses. The refrigerator and commissary department should be located directly off the kitchen, and the sleeping quarters for the cook and helper should be near the kitchen and commissary.

Where a large number of men are housed, it is usually very desirable to have a recreation room separate from the rest of the building. The heating plant should be centrally located and large enough to take care of the necessary hot water for kitchen and showers, unless a separate unit is desirable in the shower room.

The desirable arrangement for toilets is in a central location in a separate wing of the buildings between the sleeping quarters and the showers. If this arrangement is used the hot water tank for shower baths can be in the same wing of the building, with the storage tank and heater combined. All rules governing sanitation for camp cars should apply for portable bunk houses.

The advantage of a portable camp is that it can be moved when necessary. It can be

Bridge and Building section

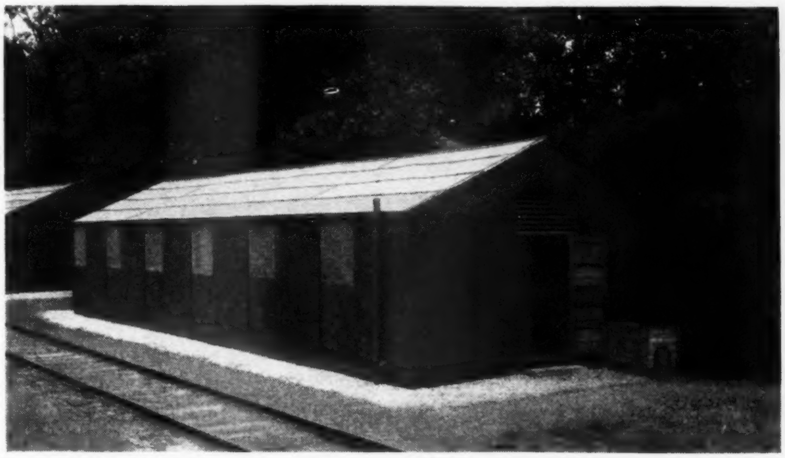
located near the work, and thus effect a large saving in man hours traveling to and from the camp.

A portable camp can also be located where water and other facilities can be obtained at minimum cost. This will result in large savings if the railroad is able to use its own source of water supply, power, etc.

Conclusion

In housing bridge and building department employees, the important thing to consider is to provide as many of the comforts of home as it is possible to provide and properly maintain. This is desirable from a morale standpoint in order to keep the off-hour needs of the men as well satisfied as possible while they are away from their homes. Railroad men today, especially in the mechanics' class in B. & B. work, will not be content in their jobs unless this is done, and a heavy turn-over in skilled labor will follow, with resultant loss of efficiency in the gangs.

All this means that comfortable quarters with good heating and lighting facilities, shower baths, plenty of room for recreation and reading, and, most of all, good meals, are necessary to obtain the best results from B. & B. road forces. A good safe workman must be a satisfied workman.



Prefabricated bunk houses are often advantageous for portable-type camps

Most railroads recognize this, and have generally improved, or are now improving, the housing facilities of their road forces, including B. & B. forces. Dividends from the investment in such improvements will be paid in greater efficiency and productivity of their forces.

Discussion

President Hancock referred to that part of the report dealing with camp cars and stated that his road recently built some

shower cars for bridge and building gangs because they included many veterans whose military training taught them to enjoy showers and accept them as part of good personal hygiene.

F. M. Misch (S.P.) stated that each of his crews has a bunk car equipped with two showers, it being found that one shower was insufficient for a crew. A recent improvement on his road, he stated, was the assignment of at least one remodeled Pullman tourist car to each road gang but, because these cars might again be used in revenue service, the remodeling work was limited and the men did not have all of the room they felt to be necessary.

E. H. Barnhart (B.&O.) recommended that side tracks be disconnected from the main track when camp cars are spotted on them. This is safer than the use of derails, he said. When Mr. Barnhart inquired if any road was using troop sleepers, W. K. Manning (Erie) reported that his road had assigned some to its signal department forces but, as yet, none was being used by bridge and building crews. He also observed that one fault of many camp cars is in having an inadequate electric power supply to run power pumps and refrigerators, and that it would be better to design camp cars to have a separate room for each man.

W. C. Harman (S.P.) stated that his road had remodeled some cars having steel underframes to provide six bedrooms, each about 6 ft. by 7 ft., so that every man could have a private room, with a lockable door, where he could have his radio and other personal possessions. Each of such cars on the road's southern lines has a stove for heating purposes but, on the northern lines, each car has steam pipe coils extending from a small central heating plant for the full length of the car.

Lee Mayfield (M.P.) said that he was recently assigned some old 70-ft. coaches for redesigning into camp cars. His plans contemplate a room, approximately 10 ft. square, at one end of each car for an assistant foreman, and the use of the adjoining 11 ft. of car length for a shower room. At the opposite end of the car, 12 ft. of the car length will be fitted as a recreation room, while the intervening space will have a center aisle, with bunks and lockers on each side for accommodating 10 men.

Answering a question by J. A. Hanson (N.Y.C.) regarding the ventilation of camp cars, Mr. Mayfield said that some cars are provided with large fans at one end of the center aisle while others have window fans.

Types of Bridges for Replacing Timber Trestles

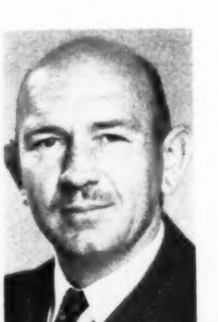
Report of Committee*

AMERICAN railroads are today faced with excessively increased costs of operation and maintenance. Labor costs have increased a considerable amount and material costs have shown progressive increases, with totals now aggregating as much as double the costs of 10 years ago.

Wooden bridges and timber trestles for railroad use date back to the first railroad construction in the early 19th century. Steel has gradually replaced wooden bridges so that now we find only a few Howe trusses in use on light-traffic lines. However, the use of timber trestles still remains as standard on many American railroads.

In the preparation of this report a comprehensive study was made regarding the economy of construction, annual maintenance expense and replacement costs of timber trestles in use throughout the United States. These costs were then compared with similar costs of permanent or semi-permanent types of construction used for replacing timber trestles. More than 100 main-line railroads were asked by questionnaire to furnish data suitable for this study, and the answers received are summarized.

The prime purpose of this report is not only to suggest types of bridges for replacing timber trestles, but also to review possible savings for the railroads by decreasing maintenance costs through suitable and economical construction.



F. M. Misch
Chairman

Cost of Timber Trestles

From data furnished by various railroads, the present average cost per lineal foot to replace single-track timber trestles, using creosoted piles, average height 10 ft., was found to be as shown in the accompanying table.

Variations from maximum to minimum result from cost of material differentials, density of traffic and methods of construction. However, it is interesting to note that, from the majority of roads reporting, the overall percentage increase in timber trestle replacement costs from 1938 to 1948 was an average of 142 per cent. Increased labor rates and decreased labor efficiency, together with large increases in material costs, are reflected in this increase.

Increased material costs are reflected in the following tabulation showing average reported costs.

Item	*Cost in 1938*	*Cost in 1948*
Untreated piling (lin. ft.)	$ .20	$ .45
Creosote piling (lin. ft.)	.53	.95
Select structural timber (m.b.m)	54.00	110.00
Other timber (m.b.m.)	28.00	71.00

Placing costs have increased in a larger proportion than increase in wages. This can be attributed, in part, to the fact that many railroads are no longer able to employ enough trained carpenters for trestle construction. This can only be corrected by adequately equipping present gangs with power tools for greater efficiency. Present-day framing and placing costs were reported at from $40 to $75 per MBM on an average, with several roads reporting framing and placing costs up to $160 per MBM.

Average annual maintenance costs for open-deck trestles have shown a definite increase. These costs were reported as a minimum of $1.00 to a maximum of $3.00 (per lineal foot of trestle). Ballast-deck trestles were reported to have a much lower average annual maintenance cost, varying from $0.10 minimum to a maximum of $1.50 per lineal foot of trestle.

In studying the service life of timber trestles, open-deck trestles were considered in component parts. The reported *average* service life of these parts is tabulated below:

	Untreated	*Treated*
(A) Ties	11 years	20 years
(B) Stringers	14 years	28 years
(C) Caps	12 years	20 years
(D) Bents	10 years	27 years
(E) Bulkheads	11 years	31 years

It will be noted from the above that, with normal open-deck trestle life, replacement of ties, stringers and caps can be expected before bent renewal. The number of deck replacements will vary depending upon whether treated or untreated, density of traffic and climate. With nominal repairs, open-deck trestles have an expected service life of 20 to 25 years.

With treated ballast-deck trestles, service life for the entire structures were reported at from 35 to 40 years as an average. However, it was further reported that cap renewals could be expected within 25 to 30 years.

When a timber trestle reaches the end of its service life, comprehensive engineering and economic studies should be made to

*Chairman of this committee was F. M. Misch, general bridge and building supervisor, Southern Pacific, San Francisco, Cal.; vice-chairmen were A. Bober, bridge and building engineer, Gulf, Mobile & Ohio, Mobile, Ala., and J. M. Giles, resident engineer, Missouri Pacific, St. Louis, Mo.

determine the most economical and suitable structure as a replacement. This comparative estimate will be based on an assumed life period for the timber trestle as against the life period of a permanent or semi-permanent structure. This estimate should give the following details:

(1) Estimated service life
(2) Cost of renewal or replacement
(3) Cost of maintaining traffic
(4) Total cost of structure
(5) Annual interest on total cost
(6) Annual maintenance cost
(7) Annual amortization cost
(8) Total annual cost
(9) Annual gain or loss by replacement.

In this type of comparison, use of permanent structures may appear uneconomical in comparison with timber-trestle replacements, except culvert and fill replacements, which will be discussed later. No doubt, timber trestle replacements with treated bents will be found to be more economical than permanent bridges and can be justified for use on branch lines where the life of the line is in question. However, on high-speed main lines where safety and continuity of service are essential, greater weight must be given to the value of a permanent or semi-permanent structure.

Important Considerations

The majority of railroads reporting stated that fire hazard and damage to trestles by drift were important considerations in determining structure replacements for main lines. Several roads, however, justified the use of creosoted ballast-deck trestles on main lines and open-deck trestles on branch lines on the basis that such trestles are flexible and that the material can be salvaged in case of relocations of the lines.

Where short spans are not objectionable and culvert installations are impossible, the use of timber trestles will, no doubt, be used for some years to come by some railroads, even though first cost of construction may rise higher than at present.

All roads reported that, where changes in construction were considered, engineering data is obtained before making trestle replacements. Situation surveys, including drainage areas, expected flood run-off, and bridge areas of adjacent state highways and railroads, are made to determine the size of waterway required. Observations of field men are considered essential.

Elimination of Fire Hazards

The elimination of fire hazards on trestles was strongly stressed by all concerned. Annual maintenance costs included the scalping or removing of grass and brush from underneath trestles and the removal of drift at all times. Water barrels and sand boxes were considered impractical unless the structures are near habitation. Where trestles are being used, galvanized covering of the stringers and caps is recommended by some roads; also concrete firebreaks spaced a minimum of 350 ft. apart. Covering of the ties with metal or with an asphalt-asbestos coating and rock chips was report-

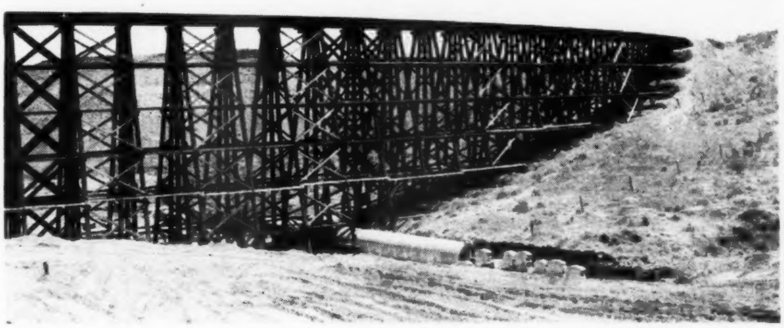
Cooper's Loading	*Open Deck* (Untreated deck)	*Ballast Deck* (Treated deck & bents)
E-40	$40 Min. to $65 Max.	
E-60	53 Min. to 70 Max.	$70 Min. to $100 Max.
E-72	60 Min. to 75 Max.	75 Min. to 105 Max.

Bridge and Building section

ed to be satisfactory as a fire preventive.

In regards to comparative construction costs and future maintenance costs of timber trestles as against semi-permanent or permanent structures, a diversity of ideas was offered. The ratio of the cost of timber trestles to semi-permanent structures has decreased and will continue to do so. Where the life expectancy of a line is at least two cycles of service life of a treated structure, consideration should be given to permanent construction. One road stated that it is using permanent construction when the estimated cost of this construction is not over 150 per cent of treated trestle cost. Another stated that trestle replacements were recommended when repair costs amount to 15 per cent or more of total renewal cost.

Considerable stress was placed by the majority of the railroads on the possibility of reducing trestle openings to actual effective area of waterway required as determined by situation and drainage surveys. Where this waterway can be handled by a culvert or multiple culverts, the culvert installation and filling to standard roadbed section can often be accomplished at a cost comparable to trestle replacement costs. An analysis of these comparative costs is given in one of the accompanying tables.



Low grading costs with modern machines often justifies culvert and fill construction

Cost vs. Life Expectancy

In the cost comparison you will note the use of an open-deck trestle gives the required structure at a lower first cost. However, in comparing the life expectancy of the structures, a semi-permanent structure will provide a lower annual cost than an open-deck trestle.

The railroads reporting recommended many types of permanent or semi-permanent structures for timber trestle replacement. It is considered that any structure having an estimated service life from 50 to 75 years can be classified as a semi-permanent struc-

Trestle Replacement—Single Track
ESTIMATE OF COST-ALTERNATE TYPES

	10-ft. Conc. Arch	*120-in. Multiple Metal Plate Pipe*	*45-ft. Open-Deck Creosote Trestle*
Effective area waterway	72.6 sq. ft.	78.5 sq. ft.	182 sq. ft.
Length of barrel	38 ft.	40 ft.	
Concrete in barrel	126 yd.		
Cost of concrete @ $30 yd.	$3,780.00		
Cost of 120" dia. pipe F.O.B. factory		$1,721.00	
Freight, store expense, unloading, installing, use of tools, move gang	$ 449.73	$ 520.32	
Plus 10 per cent for contingencies	$ 422.97	$ 224.13	
First cost, exclusive of headwalls	$4,652.70	$2,465.45	$3,375.00
Filling 3 bents @ 40c yd	$ 501.40	$ 548.60	
Cost 2 portals 100 yd. conc. @ $30	$3,000.00	$3,000.00	
First cost installed comp.	$7,652.70	$5,465.45	$3,375.00
Life expectancy for annual cost comparisons	75 years	60 years	30 years
Interest at 4 per cent on installed cost	$ 306.11	$ 218.62	$ 135.00
Annual maintenance (after 5 years)	....	....	$ 60.00
Annual amortization at 4 per cent	$ 17.83	$ 22.95	$ 60.18
Annual cost installed	$ 323.94	$ 241.57	$ 255.18

The Missouri Pacific was represented by this large group and several others in addition. Left to right, they are, W. A. Krauska, draftsman; W. B. Bunge, asst. engr.; C. U. Faircloth, br. insp.; S. R. Thurman, b. & b. supvr.; A. A. Hampton, b. & b. supvr.; A. A. Miller, ch. engr. m. of w.; Lee Mayfield, res engr.; F. I. Nelson, wat. ser. fore. (in rear); J. M. Giles, asst. engr.; J. J. LaBat, b. & b. supvr.; W. A. Huckstep, gen. bldg. supvr.

ture. Service life of over 75 years classifies such a structure as a permanent structure. It will not be possible to give the full details relative to these recommended types as each structure will vary in relation to actual stream crossing and engineering design. Furthermore, the actual cost per lineal foot will vary with job conditions and traffic intensity. However, it is interesting to note that many railroads reported that construction costs of permanent structures were being greatly reduced by careful studies of each job in regard to the elimination of falsework and standardization of similar jobs.

Concrete Trestles

Six railroads reported the use of reinforced concrete trestles on high-speed main lines. The type of structure and first cost were justified by the greater economy of maintenance, elimination of fire hazard and, in some cases, freedom from marine borer attack. In general, the construction consists of precast reinforced concrete piles, poured-in-place reinforced concrete caps, and precast reinforced concrete slab decks. One road reported a similar type of construction but used piling of spiral welded pipe filled with reinforced concrete. The pile length was a maximum of 90 ft. below cut-off. In the above cases these permanent structures were of the ballast-deck type and have required no further bridge maintenance. None has been in use long enough to obtain maximum service life, but this type of construction can be estimated to have a minimum service life of 75 to 80 years.

Steel Beam Stringers

A larger number of timber trestles have been replaced with I-beam or wide-flange steel beam stringers, with span lengths up to 50 ft. Various types of support have been used in this type structure, such as reinforced concrete piles, steel H-beam piling, steel pipe and steel tube piling, and reinforced concrete piers resting on rock or foundation piles. It was recommended that, with steel H-beam piling, the piles be encased in concrete from pier cap to 3 ft. below ground line. With the above types of pile supports, caps have been either poured-in-place reinforced concrete or steel beams. Steel beam stringers will vary, depending upon length of span and rated loading. Both I-beam and wide-flanged beams are being used with further fabrication as to cover plates and cross frames as are necessary. One structure was constructed with built-up, wide-flange beams fabricated from steel plates by welding.

The average first cost of this type of construction cannot be arrived at except for individual structures, as there is too great a variance in span lengths, type of support and type of deck. The majority of structures of this type reported on have open-deck floors. However, several railroads reported the use of wrought iron or creosoted timber decking for ballast decks on steel beam stringers. Annual maintenance of these structures will involve painting maintenance work on the steel and deck maintenance on open-deck structures.

An interesting and economical structure reported on consisted of steel stringers made from an obsolete steel truss. The top chords and end posts were cut to the length of the new openings and were placed on concrete abutments and piers. Deck plank for the ballast deck was creosoted lumber.

T-Rail Spans

Another economical type of structure reported on for short spans consists of T rails (90 lb. per yd.) on pile-bent or concrete-pier supports. This type of construction was used for either open-deck or ballast-deck trestles. Bearing plates were installed on top of the timber caps. For longer spans light I beams were used. In this case, however, steel I-beam caps on timber piles provided the support.

Steel Girders

Several railroads reported the installation of steel girders, both deck and through-girder construction, to eliminate timber trestles. These installations were found necessary as the short-span trestles were creating hazards due to the blocking of the streams with drift or to ice flow damage. The girders were designed for the particular Cooper's E rating on the line involved. Supports for these various girder spans were either reinforced concrete piers or concrete or steel pile bents. The cost per lineal foot of the girder replacements was considerably in excess of the cost to replace the trestles in kind. However, stream conditions indicated definitely that longer spans were required to handle flood or ice flows and still provide for safe, high-speed train traffic without interruption. Fire hazards were greatly decreased, especially in the case of the ballast-deck girder spans. These installations will require a nominal amount of maintenance, such as steel bridge painting and deck maintenance on the open-deck spans. The use of treated ties on these open decks will definitely increase deck life and reduce maintenance. Girder construction on permanent supports will give an estimated service life of 50 to 75 years.

No railroad reported the installation of steel truss bridges to replace timber trestles, all truss installations being noted as replacements of older truss spans. Any recommendation covering steel bridge or steel girder installations can only be made after a very comprehensive engineering study has been made of the particular stream crossing involved. General rules for such installations, therefore, cannot be considered in this report.

Culvert and Fill Construction

In the construction of early railroads in the United States, it was found in many cases that timber trestle construction was more economical than the construction of high roadbed fills. This was due to the fact that timber trestle construction was then relatively cheap, while grading by hand or horse-powered equipment was relatively slow and expensive. Today we still find many timber trestles, especially on our western railroads, that are of greater length than required for stream flow.

With the continued increased cost for timber trestle construction, detailed engineering studies should be made before any trestle replacement in the above category is made. Modern grading equipment has proved its place in railroad construction—excavating, hauling and building roadbed sections at locations far distant from the cuts or borrow pits. Grading costs with such equipment are relatively reasonable and engineering studies often indicate that trestles can be replaced economically by culvert and fill construction.

All of the railroads asked to participate in this study were questioned concerning their experience in trestle replacement by culvert and fill construction. Various types

of culverts have been used by all the roads.

Only a few roads reported the use of treated timber box culverts. Good service life from these installations were reported as being obtained in damp climates, and laminated creosoted box culverts were reported to be in good shape after a service life of 30 years. However, possible fire hazard and increased cost of materials and labor have considerably decreased their use.

Concrete Pipe Culverts

Concrete pipe culverts have proved very satisfactory in some situations. Extra-strength reinforced concrete culvert pipe, manufactured under specifications ASTM C-76-41, is obtainable throughout the United States. However, considerable care must be exercised in its installation as a proper compact foundation must be obtained before installation. Furthermore, the larger sizes of pipe will be found to be extremely heavy and will require a locomotive crane or similar equipment for placement. The service life of concrete pipe was reported at 40 to 60 years, or longer, if properly installed.

Corrugated metal culvert, both pipe or multiple-plate type, are available in all commercial sizes and gages. The majority of railroads reporting stated that corrugated metal culverts have been used for culvert and fill trestle replacements. It was recommended that this type culvert be coated to increase its life. The service life for this type pipe was estimated at from 40 to 60 years. In the case of high fills, some installations were made with a somewhat larger culvert than required for drainage. As a result, when replacement is required in later years, a new pipe can be threaded into the old pipe at a nominal cost and without opening up the roadbed or tunneling.

Many cast-iron pipe culverts are reported in service and as having given remarkable service life. However, no new installations were reported, due possibly to increased relative costs.

Concrete reinforced box and arch culverts were reported to be very satisfactory, although somewhat expensive due to increased labor and material costs. The service life of such culverts can be expected to be at least 60 years, providing good workmanship and materials are employed in their construction.

Conclusions

In considering the types of bridges for replacing timber trestles no fixed rule or standard can be given. Each situation must be studied in line with traffic requirements, safety of operation, replacement cost and annual maintenance costs.

On light-traffic lines timber trestles have been economical and have proved satisfactory for their many years of service life. Where safety of operation and traffic continuity on high-speed lines are essential, permanent or semi-permanent construction should be given preference for replacements of timber trestles. Many types of permanent or semi-permanent construction are available for such replacements. Careful study often indicates possible replacement without traffic interference.

Annual maintenance costs on railroad structures aggregate many millions of dollars. Realization of this fact will tend to force the replacement of temporary construction, which requires so large a part of this continuing maintenance cost. Money spent in improving American railroads is money invested in American's future.

Bridge and Building section

Enlarging and Relining Tunnels For Present-Day Traffic

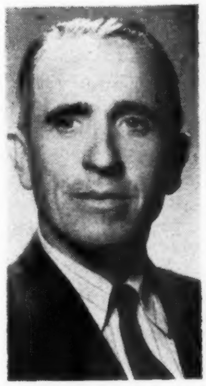
Report of Committee*

IN THE enlarging and relining of tunnels, a large number of conditions are encountered, each of which requires careful study to provide the proper construction methods and materials.

In general, the Southern Pacific has adopted a "Rib Design" for enlarging and lining tunnels under traffic. Large sections of this design have been installed on the Cascade line and on a number of the other divisions. This procedure has proved to be both economical and sufficient for the purpose.

By this method the enlargement is completed with desired clearance at the face of the timber sets, the space between the sets being filled with reinforced concrete. The timber sets may then, at some future time, be removed and their voids filled with reinforced concrete to complete a continuous concrete lining. This permits obtaining the desired clearance with less excavation than by the old method of placing the lining in front of the posts. Where pressure has required a heavier lining, a deeper post is used for the sets. This method is proposed on its Coast division and the enlargement of the bore of Tunnel No. 6 is now in progress.

Tunnel 6, which is 3,610 ft. long, is located in the San Lucia mountains, near San Luis Obispo, at the summit of the grade, on single track. The grade from the west is ascending at the rate of 0.2 per cent to a point midway through the tunnel, where it breaks to a descending grade, eastward, of 2.2 per cent. The track through the tunnel is tangent.



C. M. Eichenlaub
Chairman

The peculiar profile of this tunnel, together with adverse drafts and atmospheric pressure, causes smoke and gases to be trapped for long periods of time, making operation within the tunnels unusually difficult, in addition to causing considerable unpleasantness to passengers and crew members.

Use of Smoke Gallery

With the idea of eliminating a considerable portion of this trouble, a smoke gallery is being incorporated into the plan to extend from the east end of the tunnel to the summit, where it is to taper off for future development. This gallery, located over top of tunnel arch, when concrete lined, will have inside dimensions of about four feet wide by five feet high. Openings between adjacent timber arches of the main tunnel will permit the locomotive exhaust to enter the smoke gallery where a large portion of it will be carried to the summit and out the west end.

New timber lining is being installed with a width of 18 ft. and a height of 24 ft. 6 in. above top of rail. The old original timber lining has a clearance of 18 ft. above top of rail and a side clearance of 14 ft. at top of rail, widening to 16 ft. at the spring line.

During the process of enlarging the east end of this old bore, the smoke gallery is serving as an adit through which about two-thirds of the excavated material of the main tunnel section, and all of the excavated material of the smoke gallery, is being hauled out in mining cars. These cars are pulled by an electric tram and the material is wasted in the canyon parallel to the track.

*Chairman of this committee was C. M. Eichenlaub, resident engineer, San Diego & Arizona Eastern, San Diego, Cal.; vice-chairmen were W. R. Harman, supervisor bridges and buildings, Southern Pacific, San Francisco, Cal., and R. W. Humphreys, assistant bridge and building supervisor, Northern Pacific, Missoula, Mont.

On the west end the muck is handled in metal-clad dump boxes on push cars, hauled by motor car to the west portal, where it is picked up by a stiff-leg derrick and landed on a high-line track. Here it is taken out on a trestle, by another motor car, to chutes, where it is placed in air dump cars located on a spur-track. Finally, the muck is taken by local freight service to points where it can be dumped for bank widening.

Sequence of Operations

As indicated in the foregoing, the enlargement work in this tunnel is being carried on in four separate operations.

(1) Enlargement and installation of sills, in east end, up to spring line. 16-man gang.
(2) Enlargement and installation of timber arches and smoke gallery on east end. 8-man gang.
(3) Enlargement and installation of sills in west end, by day shift. 16-man gang.
(4) Enlargement and installation of sills in west end, by night shift. 12-man gang.

Of the above men in each gang, one is stationed about one mile west of the tunnel as a flagman and one is stationed 2½ mi. east of the tunnel. These flagmen protect workmen throughout this zone, within which there are four other tunnels. The flagmen are connected by telephone with telephone operators at each end of Tunnel 6, who keep the tunnel men advised by blinking lights of the approach of trains. These operators also handle timekeeping reports.

Tunnel 6, as well as the one next to it, is served by electric power from commercial lines in the vicinity. Two hundred-watt electric lamps are placed on the line at intervals of 100 ft. throughout the tunnels. In addition, outlets are provided at suitable places for drop cords and lamps where necessary to light up the work.

In the area at each end of the tunnel electric power is provided for lighting and for the air blower, 315 c.f.m. compressor, ½-yd. mixer, table saw, grinder, and various small drills and saws. On the west end power is available for the operation of a two-ton hoist and small tools.

The batteries on the tram car are also charged by this service. The circuit in the tunnel is so arranged that when all lights are turned off by the tunnel gangs, a train passing through the tunnel automatically lights them up. This provides light for trainmen in the event their train is stopped in the tunnel.

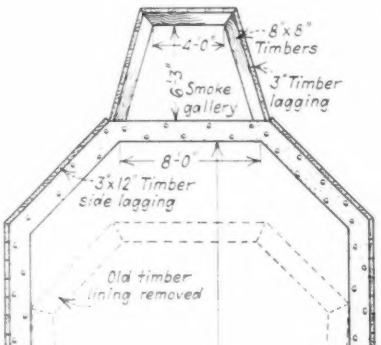
In addition to electric power, air power is used for operating jack-hammers, stope-hammers, pneumatic spades, gads, pumps for dewatering sill trenches, and the one-ton air hoist in the smoke gallery which pulls the mine cars up to the heading to be taken by train to the dump.

Sills

The first step of enlarging the tunnel involves the installation of a continuous reinforced concrete sill on each side of the tunnel to receive the new timber sets and, of course, the concrete lining. These sills are installed just behind the old timber sets, which have a clearance of only 14 ft. at top of rail.

Excavation for the sills is made to a depth sufficient to obtain a satisfactory foundation, which is ordinarily about 30 in. below top of rail. The tops of the sills are finished off at a point 6 in. above top of rail. Unstable or soft ground requires greater depth, wider footings and more reinforcement. The width between sills is 17 ft., or one foot less than that between faces of posts, which is 18 ft.

A reinforced V-shaped concrete gutter, to support the drain boxes, is allowed



Cross section showing design adopted for enlarging bore of Tunnel 6 on the S.P.

for when placing the reinforcing steel in the forms. This is done by placing stubs to protrude from the sides, to which the gutter steel will later be attached.

Weep holes are installed at 10 ft. intervals along with the concrete sills. The work in the main section of the tunnel is carried on by a foreman and 10 men.

The concrete aggregates for the sills are unloaded from cars on a spur track, at the east end of the tunnel. Here also is a cement house and a mixer. The concrete is delivered to the forms in the tunnel in one-yard steel dump boxes, arranged for unloading by means of a hydraulic lift. These boxes, hauled in on push cars by motor car, unload from the sides, which affords ease of handling and speed in getting material into the tunnel.

After completing the concrete sills, work is resumed on the sides of the tunnel, cutting it back to permit the installation of the posts and lagging. Finally the struts are placed between posts.

In preparation for future concrete lining, the timber sets are fully planked up and well packed, so that when concrete is eventually poured, there will be no giving away. All of the side cutting and installation of posts in this end of the tunnel is done on a jumbo car as there is no overhead work to be done by this gang. The gang working above the spring line enlarges the bore and sets all the arches.

Drilling and Blasting

An assistant foreman and eight men work out all the ground above the old arch sets, down to the spring line of the new arch sets. Drilling and blasting are necessary for every foot of the work. Water liner stope-hammers on 6-ft. columns are used for drilling, the water being forced to them by air pressure from a small pressure tank located on the floor of the main tunnel.

Obviously, very light shots must be placed to avoid breaking down the old, soft, original redwood sets. As a further precaution, these old sets are reinforced at the angles of the arches by spiking scab blocks on the sides. Each hole in the face must be fired independently to prevent this damage, and each blast pulls approximately six feet of depth from the face. This additional excavation of the original ground extends 6 ft. 6 in. above the old bore and 2 ft. on each side of the main tunnel.

The muck is hauled out of the tunnel in mine cars, which are pulled up a short incline into the smoke tunnel by a one-ton pneumatic hoist. From there, out to the dump, they are handled by an electric tram.

After completing a section of excavation of about 100 ft. of tunnel, the gang then sets wooden sills on each side of the tunnel at the spring line to receive the arches. These sills are framed and carefully laid, and the new arches are set up on them and completely lagged and packed. The main tunnel posts are placed under these sills by the gang below in the main tunnel, to complete the section.

After this hundred feet or so of arches is completed, the assistant foreman and his gang start excavating and timbering the smoke gallery above them. The timber lining of this gallery is composed of 8-in. by 8-in. timber posts and caps, with 3-in. plank lagging, all well packed.

The muck is taken directly through this smoke gallery in the mine cars. This gang can carry on most of its work without interference from smoke as it is supplied with fresh air blown into the heading through a rubberized, acid-resisting canvas tube, 16-in. and 20-in. in diameter, which is hung on a No. 9 wire close to the floor of the smoke gallery.

The blower, rated at 3,410 cu. ft. per min. of air at 2,000 ft. distance, is located in a shed at the portal of the smoke gallery, on top of the portal of the main tunnel. This service has been satisfactory as long as this upper section can be sealed off from the main section of the tunnel.

No concrete lining has been placed in this tunnel, except at the small section near the summit and the section at each end, already mentioned. This work was done many years ago. When enlargement of

the east one-half of this tunnel is completed the work of installing concrete lining will be started.

Tunnels 7 & 8 on S. P.

Following is a description of the enlarging and lining of tunnel No. 7, 519 ft. in length, and No. 8, 678 ft. in length, on the San Joaquin division of the Southern Pacific's main line in the Tehachapi mountains.

Both of these tunnels were unlined since their original bore, and to avoid constant combing of the deteriorated rock sections, it was decided to line them with concrete.

The enlargement of the bore was done by blasting and trimming with pneumatic gads, to get the desired rough dimensions to receive a 9-in. thick concrete lining. Reinforcing bars ⅞-in. diameter were set at 12-in. centers, vertically and over the arch, and ½-in. diameter bars were placed at 12-in. centers, horizontally throughout.

Jumbo cars were employed and constructed in such a manner that all points in the perimeter of the bore could be reached by tunnel men with the air tools to do the scaling of the bore, which was completed before construction of the footings was undertaken. The excavation was then made for the footings, and ⅞-in. diameter steel dowels were set at 12-in. centers as anchors for the concrete footings. The concrete footing was poured to top of rail, and dowels were set for vertical reinforcing bars and allowed to protrude 12 in. Weep holes 8 in. by 8 in., at 10-ft. centers, were installed. Prior to setting up the wood side forms, eye bolts were grouted into the rock sides of the tunnel, at required spacing, for holding back forms. Wood side forms, 16 ft. in length, were then set up, the tops of which were 12 in. above the tunnel spring line. These forms were then filled. This length was chosen as the maximum that could be filled conveniently in one day's pour.

The top forms, 12 in. in length, were constructed of 5-in. by 5-in. angle iron ribs, with 3-in. by 6-in. sheathing bolted to angles which were 36-in. on centers.

The concrete was mixed outside the tunnel and was hauled into the tunnel on push cars to the pneumatic placing machine, from which it was forced by air through a 6-in. steel pipe into the forms. Both sides and the top were handled in this manner. The placing machine was kept inside the tunnel in bays, at 200-ft. intervals, previously cut out of the side of the tunnel for this purpose. A force of 16 men, one assistant foreman and the foreman handled these jobs.

On the Salt Lake Division

On the Salt Lake division all concrete lining was done with the "Rib Design." This work was done by first cutting off the old timber posts and shoring them back. The excavation for sills was then made and concrete poured for a distance of 50 to 75 ft. The excavation was then made, timbers set back to standard clearance on top of the concrete sills, and reinforcing steel placed between the bents.

Portable forms, one for each rib, were constructed with 3-in. shiplap sheathing and lined with plywood to the spring line. These forms were held in place by ¾-in. by 9-in. lag screws and 3-in. walers every 2 ft. The arch forms were constructed in three sections; one on each side and one in the center.

The concrete was mixed outside of the tunnel and loaded into self-dumping buckets by a small crane, and then hauled into the tunnel with a track car. The concrete buckets were then hoisted up with a pneumatic hoist to the top of the side section of the arch form, and the concrete was dumped into the form. The bucket held 1/6 cu. yd. of concrete.

Work was carried on without delay to traffic, as there were 11-mi. indicators each direction from the ends of tunnel, which gave ample time to clear. The longest tunnel on this work was 3,926 ft.

On New York Central

In connection with the building, in 1927-1929, of a third and fourth track between Garrison and Beacon on the main line of the New York Central—along the Hudson river—two existing 2-track tunnels were enlarged and lined with concrete. One of these tunnels is north of Garrison, and the other is at Breakneck, south of Beacon. At Garrison, railroad traffic was handled during construction through an existing 2-track open cut. At Breakneck, traffic was handled during construction through a new 2-track tunnel built to the west of the old tunnel.

The old tunnels were through solid rock and were unlined except at the portals. They had a minimum cross-section approximately 25 ft. wide by 16½ ft. high. The tunnels were enlarged to 33 ft. wide by 22 ft. high from top of rail, with tracks on 13 ft. centers. The tunnel at Garrison is 464 ft. long and the one at Breakneck 515 ft. long. Practically all of the cutting was made on the easterly side at Garrison and on the westerly side at Breakneck. Rock was hard and fairly solid throughout in both tunnels, and there was no drainage problem.

A heavy timber framework was erected on a flat car, to which was attached a 4½-in. diameter steel pipe curved to the shape and size of the tunnel bore. On this pipe were mounted pneumatic drills on swivels, so they could be aimed in any direction and moved laterally on the pipe support. At the portals, in starting the cut, 330 holes, 6 ft. deep, were drilled approximately horizontal. Broaching tools were then attached and the holes were opened into each other, cutting a kerf or channel the size of the completed tunnel around a center rock core. The kerf was 6 ft. deep. Other blasting holes were drilled into this core, into which light charges of dynamite were placed and fired by from one to six delayed explosions. The kerf formed an air cushion around the seat of the explosion and, combined with the delayed blasts, caused a minimum of concussion.

Throughout the tunnel bore, back of the portals, the drilling equipment included one stoper, which was used to

drill the holes in the arch about 45 deg. each side of the crown point, and three drifters which did all of the remaining drilling. In order to minimize shock from blasting, spring holes were spaced three feet and only about ¾ lb. of explosives was used per cubic yard of rock excavated.

In the lining work, which was similar in each case, two portable form carriages were used, operating on temporary tracks, one carrying arch forms and the other forms for the side walls. In both cases the forms were of wood and were hung on the carriage frames so they could be moved inward from the neat line of the lining when it was desired to move them forward to a new position.

In order to insure true alinement and contour of the lining, without the necessity for constant engineering assistance or for keeping the form carriage tracks in true surface, the first six inches of the side walls were constructed integral with the wall footings at the time they were placed. This provided an accurate gage for securing the true alinement and proper elevation of the side wall forms as they were moved forward, and resulted in saving considerable time and expense in resetting the forms.

Twenty-four linear feet of the arch and side walls were poured on alternate days, the wall lining work always being kept in advance of the arch lining. All of the concrete was placed by pneumatic concrete gun, which operated at a pressure of 100 lb. and delivered 14 cu. ft. of concrete in a batch. The gun was discharged from a ½-cu. yd. concrete cart with a track mounting, which conveyed the concrete from a mixing plant set up near each tunnel. The lining was not started until the rock boring was completed for the full length of the tunnel. About 10 cu. yd. of concrete were required per linear foot of tunnel and the work proceeded at the rate of approximately 12 lin. ft. per day.

All of the work was done under contract at a unit price per linear foot, with extra payment for broaching. As the tunnels were short, there was no artificial lighting or ventilation problem to be taken into consideration.

On the Pittsburgh & West Virginia, two tunnels were lined with concrete which were previously timber lined. Concrete was placed using collapsible steel forms and was pumped into place, the work being done under contract.

Within recent years repairs have been made to extensive sections of double-track concrete-lined tunnels where section of the arch concrete had failed or was damaged by coal-mining operations. These repairs were made by cutting a bench near the spring line and seating thereon coated steel liner plates. Grout was forced back of the liner plates and steel plates and shot crete applied.

To avoid restricted clearances in the Greenwood tunnel of the C. & O., studies were made leading to one of the following methods of carrying out the work:

(1) Enlarging the present tunnel to modern clearance requirement.
(2) Rerouting the railroad to eliminate this clearance bottleneck.
(3) Daylighting the present track by supporting the present 4-ring brick bore to keep traffic moving while blasting and excavating operations were proceeding.

After due consideration, proposal No. 3 was decided upon as the most economical. To avoid delays to traffic while daylighting operations were in progress, a steel liner plate was used and formed to fit inside of the existing brick lining. The steel liner rings were of the box, corrugated type, 18 in. wide, made up of 10 plates so fabricated that all work of placing them was done inside. The steel liner plates were supported on timber sills which were braced to the ends of the track ties.

The Big Bend tunnel of the Chesapeake & Ohio had sufficient width, but required an increase in height of 12 in. to meet present operating requirements. A new tunnel, 100 ft. to south, was used to carry all traffic during enlargement of the old tunnel, which eliminated many of the construction difficulties. The old tunnel had a brick lining, in generally good condition, so it was determined to increase the vertical clearance by lowering the floor.

After the track was removed, a force of men with jack-hammer air drills started at west end drilling holes in the floor—which was of limestone formation—on about 12-in. centers. Another force of men using pneumatic paving breakers broke up and undercut the rock to the proposed bottom elevation of the new concrete floor. No blasting was permitted because of the hazard to the old brick lining. Excavation near the sidewalls was stepped inward approximately 18 in. to avoid undermining the brick lining. These steps served as supports for construction blocking during subsequent pouring of the new concrete floor slab.

The new concrete floor was sloped both ways toward the center, where it has a depth of 18 in. The track is supported on wood blocks 10 in. by 8 in., by 2 ft. 6 in. long spaced on 20 in. centers. These were embedded in the concrete so their top surfaces at the outside were flush with the concrete. Ties were set in cement grout mixed with an admixture to insure against shrinkage during setting and curing and to give a high early strength. This in turn insured accurate line and surface.

Discussion

In the absence of Chairman Eichenlaub, this report was read by Vice-Chairman Harman. K. L. Miner (N.Y.C.) inquired whether liner plate lagging should be left in place after completion of the concrete work on a relining job. Mr. Harman replied that this would depend upon the character of the corrosive agents back of the new lining, stack abrasion on the exposed surfaces of the liner plates if they are not protected, the precautions taken in the selection of materials, and the care given to the placing of the shotcrete covering of the liner plates.

Sanitary Facilities and Appurtenances for Railway Buildings

Report of Committee*

SANITARY facilities contribute to the welfare of all people. Therefore, the various law-making bodies are interested and promulgate laws, rules and regulations to govern the construction of such facilities.

When preparing plans for new sanitary facilities, or making adjustments to existing conditions, one must familiarize himself not only with local requirements, but also with the laws of the particular state in which such construction is contemplated. Many states have separate regulating bodies, or commissions, which pass on all plans for these facilities.

Passenger Stations

Good toilet facilities in passenger stations create much favorable comment from the traveling public, and the railroads should endeavor to construct such facilities in the best manner.

It is preferable to construct toilet rooms in passenger stations at one end of the general waiting room, and adjacent to each other so that the dividing wall can be used for piping, thus simplifying the plumbing. Sanitary fixtures should not be placed along an outside wall if it is at all possible to arrange them otherwise; this is to minimize the danger from freezing.

All walls and ceilings of toilet rooms must be plastered. The floors may be ceramic tile, or other impervious materials, and should be provided with a six-inch high baseboard, with cove at floor line of similar materials. In the more important stations, the walls to a height of seven feet may be covered with marble, structural glass, or glazed tile in order to eliminate promiscuous writing, sketching, cutting or other markings.

L. C. Winkelhaus
Chairman

Outside Windows a Requisite

It is a generally accepted requirement that all toilet rooms have outside windows. The area of such window openings should be at least 10 per cent of the floor area, and with the further provision that 50 per cent of the window can be made free opening. The lower half of all such windows must be fitted with obscure glass.

Each toilet room should be provided with a ventilating duct, which is usually constructed of galvanized iron and capped above the roof line with a syphon-jet ventilator. The lower end of each duct must have an opening just above the baseboard, covered with an iron or other metal grille. Separate ducts must be provided for the toilet rooms for each sex.

All toilet rooms should have at least one lavatory, together with the other sanitary facilities. In the larger stations, where hot water is available, washing facilities should include mirrors and electric outlets at the lavatories, and a vanity in the women's rest room.

Drinking Fountains

The sanitary facilities in passenger stations should include drinking fountains with vitrified china bowls or receptors, placed in close proximity to the toilet rooms, in order to simplify the plumbing work. Drinking fountains must be of the angle-stream type to comply with the codes of most states, and should be placed in the waiting rooms—never in the toilet rooms.

It is obvious that, where required by law, separate rooms and facilities must be provided for white and colored people.

Welfare Buildings

When necessary to provide new welfare facilities for employees, it is preferable to construct such facilities in a separate building. One building may house several

*Chairman of this committee was L. C. Winkelhaus, architectural engineer, Chicago & North Western, Chicago; vice-chairman was L. S. Marriott, general building inspector, Illinois Central, Chicago.

classes of employees, such as trainmen, enginemen, switchmen, and shopmen. However, it is customary to provide separate wash and locker rooms for each class.

New welfare buildings are usually one-story structures with a basement to accommodate the heating plant, coal storage, and other kindred facilities. A two-story structure would, no doubt, cost less, but may bring objections from those employees who are required, by reason of occupation, to carry tool boxes or other heavy equipment, to the second floor.

On account of environment and usage, welfare buildings should be substantially constructed on concrete foundations, with concrete floors, masonry walls, and proper roof structure.

The walls and ceilings of wash and toilet rooms must be plastered, or provided with other smooth hard surface for sanitary reasons and to comply with the various sanitary codes. It is good practice to apply a hard cement plaster to the lower seven feet of walls in these rooms, but the rest of the walls and the ceilings can be surfaced with ordinary plaster. All walls and ceilings should be painted with an oil-base paint. Before applying plaster to the exterior walls of such rooms, they must be furred or provided with a waterproof bond coat to protect the plaster from the seepage of moisture through the walls.

Locker Rooms

The walls of locker rooms, if of masonry construction, need not be plastered or painted. Concrete blocks or brick must be laid with neat joints in order to present a satisfactory appearance. Two or three applications of a waterproofing compound are necessary on exterior masonry walls to prevent driving rains from seeping through. Stucco, on masonry block walls, is good construction and will eliminate seepage of water through the walls.

The ceilings in locker rooms may be fiber board, plaster board or asbestos-cement board, fastened directly to the ceiling joists. It is becoming general practice to insulate all suc hceilings in order to conserve heat. It is essential to ventilate the attic space over insulated ceilings in order to prevent moisture damaging the insulation.

The floors in welfare buildings should be of concrete, and, for sanitary reasons, a six-inch high base of the same material should be provided in all rooms. It is well to provide floor drains so that rooms may be flushed with water when necessary.

Ventilation

All rooms must be ventilated. Ventilation for toilet and wash rooms is obvious. It is necessary for locker rooms to provide both general air circulation and circulation in lockers where clothing may be damp. Ventilation may be provided by metal ducts from the floor line to above the roof, connected to a syphon-jet ventilator of proper size. Grilled openings at the lower ends of the duct are placed just above the baseboard. This ventilation is in addition to that provided for by window openings.

The window area must be at least equal to 10 per cent of the floor area of each room. The windows may be of wood or metal, and of such design that at least 50 per cent of the window area will open. The glass in the windows in the toilet and wash rooms should be of an opaque type, and, in some cases, the lower half of locker rooms windows should be glazed with such glass.

Doors

Doors should be of ordinary wood construction, and may be pine or fir, suitable for painting. It is preferable not to provide glass in the upper panel of these doors. The exterior doors should be 1¾ in. thick, and interior doors 1⅜ in. thick. A latching device is all that is necessary in the way of locks, as such buildings are seldom locked. Liquid door closers should be provided, especially on doors leading to toilet and wash rooms.

In certain localities it is important to provide fly screens for all windows and doors.

Sanitary Fixtures

All sanitary fixtures should be the best obtainable. In fact, many sanitary codes describe the minimum that will be acceptable. From these codes one also determines the number of each kind of fixtures required for the particular job in question.

To ascertain the number of fixtures required for any particular job, it is necessary to determine the maximum number of men on any eight-hour shift. Various states employ different methods of figuring the minimum number of fixtures required, and their codes should be consulted. However, the minimum requirements are about as follows:

1 wash bowl, or wash facility for each 10 men or fraction thereof;
1 water closet for each 20 men or fraction thereof;
1 urinal for each 50 men or fraction thereof;
1 shower stall for each 20 men or fraction thereof.

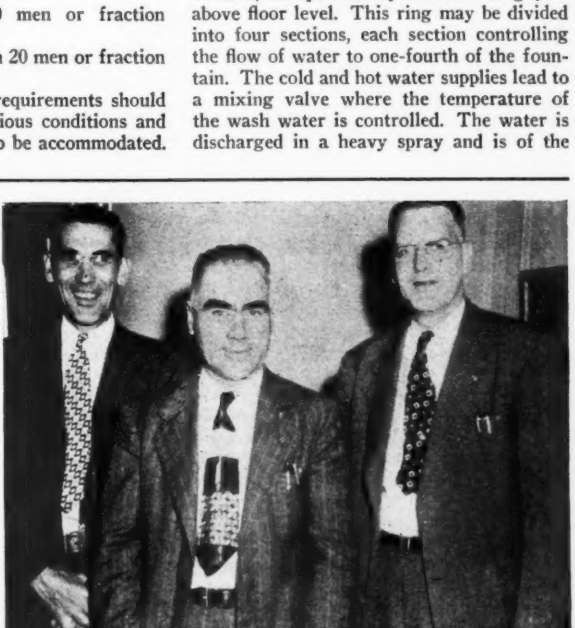
The above minimum requirements should be modified to meet various conditions and the class of employees to be accommodated.

Bridge and Building section

Where all the men begin and stop work at the same time, it is essential to provide more wash facilities than the minimum required. If the men go home at the close of each work day, it is possible that the shower stall requirements may be reduced, or eliminated entirely. However, in the case of trainmen and enginemen, the minimum requirements should prove adequate.

Wash facilities—The designer may select individual bowls, the trough type, or the circular wash fountain, but it may be advisable to consult local representatives of the employees as to what type is preferred. With the individual bowl, each user can temper the wash water to suit himself. Some codes prohibit the use of stoppers with individual bowls, as they are usually left in an unsanitary condition when stoppers are used. The wash trough seems to be ideal for most installations. Such troughs are single or double; the single for wall-hung installations, and the double for free standing installations. Hot and cold water lines join at a single spigot and the running water can be tempered to the degree desired by the individual. The circular and semi-circular wash fountains have come into use within the last decade or so. These fountains are mounted on a single pedestal and are constructed of concrete with aggregates of various colors and textures. In recent years stainless steel has also been used for fabricating such wash fountains.

These fountains are particularly adapted to installations where many men wash at the same time. The flow of water is usually controlled by a foot-operated valve which, in turn, is operated by a metal ring just above floor level. This ring may be divided into four sections, each section controlling the flow of water to one-fourth of the fountain. The cold and hot water supplies lead to a mixing valve where the temperature of the wash water is controlled. The water is discharged in a heavy spray and is of the



A group of Erie representatives. Left to right—William P. Karwich, trav. br. insp.; W. K. Manning, supvr. br.; C. A. Roberts, engr. of struct.

The Chesapeake & Ohio was well represented at the meetings. Left to right—George Rader, trk. supvr.; Paul D. Haines, b. & b. supvr.; H. M. Harlow, asst. gen. supvr. b. & b.; H. E. Kirby, cost engr.; D. F. Apple, div. engr.; W. R. Graham, asst. supvr. b. & b.; M. J. Hubbard, gen. supvr. b. & b. (rear); A. E. Botts, asst. ch. engr.; W. W. Caines, asst. supvr. b. & b.

same temperature for all users of the facilities.

Water closets—The bowls of water closets should be of the elongated type; in fact, many codes require this type of bowl. Seats with open fronts and no covers should be used. Plastic seats are preferable, and, if deemed necessary for any particular installation, they may be of the self-rising type. Closets, equipped with flush valves and vacuum breakers, are preferable to the low-down flush tanks or high tanks. Flush valves require at least one-inch supply lines and 15 lb. water pressure. Where adequate pressure is not available, flush tanks must be used, and, if the low-down type, it is desirable to provide them with lock-on covers.

Urinals—Floor-type urinals, with automatic flushing device, are usually preferable. They need not be more than 18 in. in width, and, if in batteries, should be placed on 24-in. centers. It is common practice to slope the floor of the toilet room toward floor type urinals in order to eliminate the necessity of floor drains. Wall hung or pedestal-type urinals are satisfactory and are preferred to the floor type in some localities. The trough-type urinal may be suitable in certain instances. If used, proper metal shields must be used and placed on 24-in. centers. This type urinal is not as sanitary as the other types and is seldom used in new work.

Shower stalls—Shower stalls can be obtained as a unit, complete with integral base, drain, shower heads, supplies, etc., and this type is preferable. The stall should not be less than 36 in. by 36 in. by 72 in. high. In addition to the shower stall, it is necessary to provide a dressing compartment adjoining the shower stall, of the same height and width, and at least 42 in. long. A small seat or bench is usually placed in the dressing compartment. Curtain rods, canvas curtains, etc., should be provided for both the shower stall and the dressing compartment.

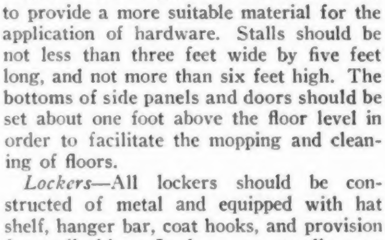
Drinking fountains—A drinking fountain must be installed in each locker room—not in the toilet or wash room. This facility should be placed on a wall adjacent to the wash room so as to minimize the amount of plumbing work. Only drinking fountains of the angle-stream type should be considered.

Toilet stalls—It is best to provide metal toilet stalls, complete with all appurtenances, such as door latches, coat hooks, paper holders, etc. In the more important installations, structural glass, marble or enamelware might be used, and, where such are used the doors should be of wood or metal to provide a more suitable material for the application of hardware. Stalls should be not less than three feet wide by five feet long, and not more than six feet high. The bottoms of side panels and doors should be set about one foot above the floor level in order to facilitate the mopping and cleaning of floors.

Lockers—All lockers should be constructed of metal and equipped with hat shelf, hanger bar, coat hooks, and provision for padlocking. Lockers are usually constructed with legs 6 in. high, and can be obtained with sloping tops, which discourages the placing or storage there of various articles.

The size of the lockers may vary considerably, and depends upon the class of employees to be accommodated and the state in which the facility is located. Some railroads standardize on the maximum size required by any code in their territory. This is so the lockers can be used on any part of the system, and at the same time show no discrimination.

Steel lockers should be ordered in groups in order to save metal and reduce cost. However, the grouping should not include too many lockers, i.e., not more than three, four or five openings wide. The groupings can be single face or double face, and one should specify when ordering. It is customary to ship metal lockers "knocked-down" to save shipping space and to facilitate placing them in rooms.



Water Service

The water supplied for use in welfare buildings must be potable—that is, fit for human consumption. In most cases, municipal water service is available; however, in some isolated localities a well must be drilled and the state health authorities will require certain tests before certifying it as an approved well.

It is necessary to furnish an adequate supply of hot and cold water to the various fixtures. Cold water presents no problem, and hot water can be provided in various ways. If steam is available the year round, hot water can be made through the use of a steel storage tank fitted with heating coils. Should the building have its own heating plant, hot water can be made through an indirect heater, coils or other fitting in the fire box. Of course, this is only during the heating season. For the summer months, an auxiliary small hot water heating boiler can be installed.

It is always a source of annoyance as to who shall fire the boiler to provide hot water. Therefore, it is well to consider the installation of an oil-fired plant for heating hot water. If gas is available, the installation of a gas-fired hot water heater and storage tank may be considered. It is an ideal arrangement and well worth the additional cost of operation. Where only small storage quantities of hot water are required, electric hot water heaters are suitable.

Sewage Disposal

In most instances municipal sanitary sewers are available for sewage disposal. Where they are not, a septic tank must be installed. Septic tanks are satisfactory and require very little attention if properly installed. The effluent can be discharged into a dry-well, or through a system of farm drain tile.

The foregoing report covers general principles which are consistent with good practice. Each proposal must receive individual consideration, and the installation made should satisfy the personnel involved.

Discussion

In reply to a question from E. R. Schlaf (I.C.), Chairman Winkelhaus stated that where sink stoppers are not used it is not always customary to install mixing faucets. W. A. Huckstep (M.P.) said that temperature-control regulators, set for 115 deg. F., were always used with mixing faucets on his road to preclude the possibility of persons being burned.

Commenting on that part of the report which stated that it is good practice to apply hard cement plaster to the lower seven feet of walls in toilet rooms, W. C. Harmon (S.P.) stated that he preferred to use a ceramic wainscoting to about the same height.

WHAT'S THE ANSWER?

An open forum for maintenance men on track, bridge, building and water service problems

Distribution of Emergency Rails

What factors determine the number and distribution of emergency rails kept on hand in single and double-track territory? Should a flexible or fixed policy be established in this regard? Why?

Base Policy on Experience

By J. R. Scofield
Assistant District Engineer, New York Central, Detroit, Mich.

The factors governing the number of "change rails" distributed on each subdivision are as follows: (1) Density of traffic; (2) number of tracks; (3) speed; (4) age of rail; (5) kind of rail; and (6) frequency of testing by rail-detector cars.

Secondary and branch mains are generally laid with relayer rail of one or more sections, in different lengths, such as 39 ft., 33 ft., and cropped rails, all of different ages, some of which have more or less corrosion with pronounced headwear. Under heavy traffic, many of these rails develop split heads and other defects due to change of stress in their new location. On this account it is necessary to hold a great many "change rails" of proper lengths and sections at convenient locations. Annual testing with detector cars is recommended to minimize the number of service breaks and reduce the amount of "change rails" kept on hand. Double-track territory of this class will require about twice the number of rails required for single-track territory, providing the gross-ton-miles and speed are proportional. A standard policy based on experience should be established.

When a rail-detector car is run, it is followed by a work train with a crane and "change rails" on cars. As defective rails are found they are replaced immediately. The replaced rails are loaded on a car as the testing progresses. This method eliminates excessive quantities of "change rails" distributed along the right-of-way.

Stock piles of emergency rails should be located at terminals where they can be quickly loaded in case a considerable number of rails are damaged or destroyed by wrecks, broken wheels or other unusual causes.

One "change rail" should be placed on a rail rest at each mile post on high-speed, double-track main lines on which: (1) The average age of the rail is not more than 10 years; (2) 50 per cent of the rail is control-cooled; and (3) a detector car is run annually. For single track of the same class with proportionally the same traffic-density, "change rails" should be placed at every other mile post to take care of emergency breaks.

For secondary and branch main lines of the class described above on double-track territory, two rails of each kind should be kept at each mile post. On single track, one rail of each kind should be placed at each mile post.

For branch lines on which there is very little traffic, a dozen emergency rails can be stored in a small stock pile at some central point on the supervisor's headquarters.

In addition to the above, a rail car can be loaded with an adequate amount of different classes of rail and kept with the wreck train as part of the equipment for emergency use.

Establish a Fixed Policy

By E. H. Barnhart
Division Engineer, Baltimore & Ohio, Garrett, Ind.

Two points must be given consideration in the distribution of emergency rails: (1) Will these rails be placed at so-called mile-post locations; or (2) shall they be concentrated at a

Answers to the following questions are solicited from readers. They should be addressed to the What's the Answer editor, *Railway Engineering and Maintenance*, 105 W. Adams St., Chicago 3, and reach him at least 30 days in advance of the issue in which they are to appear. An honorarium will be given for each published answer on the basis of its substance and length. Answers will appear with or without the name and title of the author, as may be requested. The editor will also welcome any questions which you may wish to have discussed.

To Be Answered In the January Issue

1. *To what extent has the increasing use of Diesel locomotives reduced the need for curve and grade-reduction work? What are the factors involved?*

2. *Where leaks occur in built-up roofs, how can such leaks be best located and patched? Are there practical or economical limits to such patching? Explain.*

3. *To whom should fall the responsibility of keeping station platforms free of ice and snow? Why? Does the size or location of the station affect this responsibility?*

4. *Is it practicable to strengthen ballasted-deck wooden trestles in which the panels are longer than present-day standards allow? If so how? What are the problems involved? Explain.*

5. *Can rail-end welding or end hardening be carried out during extremely cold weather without harmful effects to the rail or the quality of the result produced? If not, why? If so, how?*

6. *When should Diesel fuel-oil storage tanks be provided with heating coils? Why? Should steam or hot water be used for such heating purposes? Explain.*

7. *What are the relative merits of large bunk houses and small dwellings for permanent housing of track labor or other railway employees at fixed points? Explain.*

central point? It seems that the policy of locating emergency rails has been changing in the last few years owing to a change in the distribution of section forces, so that instead of having rails at each mile post on the section, such rails are now sometimes concentrated at the section foreman's headquarters, or toolhouse. Tests of the practicability of locating rails at section headquarters would indicate that the advantages of such distribution seem to be greater than the disadvantages. The advantages in locating such rails at the section headquarters include: (1) Greater economy in distribution; (2) a reduction in the number of rails necessary to be carried as emergency rails; and (3) the accessibility of such rails for emergency repairs. On the other hand, there is a disadvantage in having to go to the foreman's headquarters to obtain a rail in case of an emergency occurring at one end or the other of the foreman's territory. Usually emergency conditions requiring the use of rail occur at times beyond the regular tour of duty of the section forces. When they are called to take care of such an emergency, they must, of necessity, report to their headquarters or toolhouse. When they have done so, the rail to meet such an emergency is available at once.

In my opinion a definite and fixed policy should be established in the distribution of emergency rails. This policy could be established after considerable study and checking of the various points suggested above. The establishment of a fixed policy is very advantageous in maintaining a uniform appearance and policy of the railroad.

Policy Should Be Flexible

By C. Halverson
Division Roadmaster, Great Northern, Willmar, Minn.

The number and distribution of emergency rails is determined by the condition of the rail in track and the number rails found defective through normal track inspections and inspection tests made over the line by rail-flaw detectors. Other factors to be considered are the number and degree of curves, the density of traffic, number of tracks, general topography of the territory adjacent to the track, and the gradient.

A number of years ago it was the practice on some railroads to have an emergency rail at every mile post, but now, because of improvements in ballast section, ties, tie plates, and rail anchors, and an increase in the rail section, the number of emergency replacements have been greatly reduced. Now it would seem that having a few emergency rails at the stations should meet the requirements. On the other hand, in a mountain territory, or at other location where the view is restricted by numerous cuts and curves, it may be necessary to have a stock of emergency rails between stations.

In single-track territory a supply of emergency rails at every station should suffice. In double-track territory it would seem that a supply of emergency rails at the section headquarters would usually meet the requirements.

The policy should be flexible, as quite often it is necessary to increase or decrease the number of emergency rails kept on hand, depending on the condition of the rail in track and the number of defective rails located in track during the regular tests made by the rail-flaw detectors.

Rail Condition Is Factor

By Former Transportation Officer
U. S. Army

Of the many factors to be considered in deciding the number of emergency rails to be distributed on single or double-track territories, the condition of the rail now in the track, including wear and the past record of rail failures, is most important. It is well known that when rail failures begin to occur in rails of a certain length of service and age under heavy traffic, the rate at which the failures occur increases.

Hence it would be almost impossible to establish any fixed policy as to the number of emergency rails to be kept. Just how many, should be left to the officer in charge of each territory because it is he who is best informed as to rail conditions on his territory.

It has been the policy of our railroad to have at least one emergency rail for each two miles of single track. At certain locations where the rail condition warrants, two rails per mile are kept. Double track would have twice the number of rails as single track. This practice has proved effective in most cases. In cases in which new, heavier rail has been laid, I would keep only one emergency rail for every four or five miles for a period of three to four years, as there are very few instances in which a new rail will fail in that length of time. At the end of that time, the rail would be worn sufficiently to warrant the use of second-hand slightly-worn rails. Therefore, this type of rail would then be distributed in the ratio of one rail to two miles of track.

Loss of Camber in Steel Bridges

Of what importance is the loss of camber in a steel span? What does it indicate? Does it require investigation? Explain.

Increasing Loss Is Serious

By S. F. Grear
Assistant Engineer of Bridges, Illinois Central, Chicago

The term "loss of camber" is assumed to refer to a permanent deflection rather than deflection under actual live load. If a span is known to have lost its camber in this sense it would be a matter of importance and concern. To me, it could be an indication of stressing the steel beyond the elastic limit; or, in the case of a pin-connected truss, to wear on the pins or in the pin holes of the lower chord. Ordinarily, pins and pin holes of eye-bar chords do not wear, but I have known some cases where this wear did take place. Such a condition would be serious, as it would undoubtedly completely change stresses in the floor system.

Any span which might be known to have lost its camber should be carefully examined for pin wear or for loose rivets, as well as any other apparent defects. I have heard much talk of girder spans losing their camber, but I know of no case where this could be proved. We cannot tell whether a span was originally built with camber. A through riveted lattice truss on one of our branch lines has a slight sag at the center, but there is no evidence to show that the span was not built with this sag. In my opinion, if this condition has developed from stressing beyond the elastic limit, this sagging would have increased with continued traffic and this has not occurred. If this permanent sagging should continue to increase, I would say definitely that such a span should be replaced. In my opinion, the fact that a span is flat does not indicate anything serious. Probably it was built that way.

Uses for Finned-Pipe Radiators

Where can finned-pipe radiators be used for heating shops, enginehouses, passenger stations and other buildings? Can they be combined effectively with other types of heating facilities?

Suited to Limited Space

By J. B. Schaub
Assistant Engineer of Buildings, Illinois Central, Chicago

A finned-pipe radiator is a very efficient and, in many cases, a desirable type of radiator. It may be used for heating practically any space except, possibly, that which requires a specific type of heat. For example, it is found most desirable to use a hot-blast heating system for enginehouses. Finned-pipe radiators are found to be very desirable where the space is limited or where the radiator must be in an unusual position. This type of radiator can be combined very effectively with other types of heating systems because of this characteristic. Where insufficient radiation can be obtained from other types of heating that are found to be more economical, it is possible to supplement it by placing finned-pipe radiators in restricted or unusual locations.

In some installations, especially shop buildings where miscellaneous heavy repair work is being done, it may be advisable to install some type of guard to prevent damage to the pipe fins.

Useful in Remodeling Work

By W. G. Harding
Architect, Wabash, St. Louis, Mo.

Finned-pipe radiators were originally developed to destroy skylight, window and wall drafts, but they have proved adaptable for use as supplements to unit heaters in large areas. In this combination they are used under windows, along walls and in those hard-to-heat corners or small areas where a great amount of heat is required, such as work benches beneath large window areas.

They are as easily installed as an ordinary length of pipe and occupy little space normally used for other purposes. They provide a high heating capacity at a small cost and may be used in combination with other heating equipment employing steam or hot water as the heating medium with a minimum change in the heating layout. They have been used successfully in much remodeling work because, owing to their light weight, they are readily supported by existing construction, whereas other types of equipment might impose excessive loading. Finned-pipe radiators may be recessed into walls or placed in wall cabinets which are narrower than the conventional type of cast-iron radiators.

Disadvantages of finned radiators are: (1) The small spaces between fins are collectors of dirt, lint, etc., and must be kept clean for maximum efficiency; and (2) tiering of units, which is often desirable, reduces efficiency if the tiers are closely spaced and heat in such tiers is difficult to control automatically.

Preventing Incrustation in Pipes

Can new or in-service pipe lines be treated to prevent incrustration or the formation of tubercles? If so, how? What are the advantages?

Uses Several Methods

By William G. Banks
Division Engineer, Division of Water, City of Newark, N. J.

In outlining the practice and experience of the city of Newark in the prevention of incrustation, let's discuss new pipe lines first and in-service lines next.

In new lines, 2 in. and smaller in diameter, the city uses lead pipe, copper tubing or brass pipe. In 3-in. and 4-in. pipe lines, which are principally service lines, tar-dipped cast-iron pipe is used. For cast-iron pipe 6 in. and larger in diameter, the city uses a bituminous enamel lining, applied in our storage yard previous to the installation of the pipe, or cement-lined pipe purchased with the lining in place. For lines 36 in. and larger in diameter, it is our practice to use precast, reinforced-concrete, pressure pipe, or steel pipe. In the case of steel pipe, to date we have either purchased it with a spun bituminous lining placed at the mill, or, if the job is not extensive, have hand-daubed the bituminous lining in the field, prior to placing the pipe in the trench.

In regard to pipes in service in the ground, no treatment is required in the case of lead, copper or brass in the Newark system. Cast-iron pipes placed in the past without protective lining have in a few instances been cleaned and lined to prevent the reformation of rust tubercles. In lines 20 in. and smaller in diameter, the only linings which we have placed have been by an electrolytically-deposited asphalt process. This process was used in lining two 20-in. pipes and in a short section of 4-in. pipe.

Most of our re-lining has been with a cement-mortar lining in pipes 24 in. and larger. All of the 24-in. pipe has been cast-iron, and used in the distribution system. The 36-in., 42-in. and 48-in. pipes which the city has lined with cement have been largely steel pipes. These pipes are fifty years or more old. We have been doing this latter type of work, that is, cement lining in steel water transmission lines, since about 1935.

We are satisfied that the cement-mortar linings will give protection for many years. We consider the patented asphalt process as not of the same permanency as the cement-mortar lining, expecting protection for only 15 years or so in the Newark system with its exceedingly soft water. This conclusion is based upon experience elsewhere and not in Newark, since this type of lining has only recently been placed.

Coat Pipe With Asphalt

By Alfred B. Anderson
Chief Engineer, Water & Sewer Division, Pittsburgh Pipe Cleaner Company, New York

There are several good coatings on the market for new water pipe. They include specially-processed asphalt and coal-tar products as well as cement. Cast-iron water pipe can be purchased with the type of coating preferred by the customer.

For the rehabilitation of in-service water pipe in all sizes from 3 in. in diameter up to and including 24 in., there is our process. In pipe 24 in. in diameter and up, cement linings can be placed by machines or by the gunite method.

All of the above coatings have been used successfully by the water works industry to prevent tuberculation. In addition, lime, sodium, hydroxide and soda ash are some of the alkalies used to reduce or retard corrosion chemically. Incrustation is usually caused by the precipitation of mineral matter

from the water. This precipitation may be from the original water or as a result of chemical changes after water treatment. Coating a water pipe will not prevent incrustation.

Our method of lining old water mains in place has been used successfully in this country for the past two years. The process was developed in England some 15 years ago and to date some 3 million feet of pipe have been successfully reconditioned by this method. After thoroughly cleaning the pipe, the process involves the deposition of an asphalt coating, electrolytically, from an aqueous solution. The resulting coating on the pipe resists tuberculation for a number of years. Examination of pipe after 10 years of service indicates complete protection. The life of the coating beyond the 10-year period can only be estimated. There have been varying predictions as to the permanency of this coating, ranging from 20 to 30 years.

When one compares the cost of renewing water pipe with the cost of rehabilitating existing mains, the economy of the process practically dictates rehabilitation in preference to replacement.

Contracting for Coal Supplies

Is it practicable to contract with local coal dealers for supplying the fuel needs of stations, office buildings, crossing watchmen's shanties, towers, etc.? Explain.

Questions Economy

By I. C. Brewer

Division Engineer, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.

On our middle-western territory we doubt whether it is economical to handle coal needs for these small buildings locally. The difference in price of the coal is enough to make it cheaper for us to supply these places with company coal, even though we have to spend something in transporting a car over the line and arranging for labor to fill the bins at the various stations involved.

Economical in Many Cases

By Roadmaster

In many cases it is not only practicable but economical to contract with local coal dealers for supplying fuel. On the other hand, local conditions of price and supply may so reduce the economy as to make contracts impracticable. Consequently, fuel delivery conditions in each locality must be studied carefully from the standpoint of cost, service, amount of lost labor, the availability of coal cars, trucks, etc. Quite often such detailed studies will reveal poor practices being followed, the high costs of which were not readily discernible before being investigated.

Before giving this subject much thought we used to supply all our fuel needs from work trains handling gondolas of company coal. This practice, besides being difficult to plan, was often hard to execute to the satisfaction of everyone. Train schedules and emergencies continually disrupted our fuel deliveries.

In studying ways to alleviate our troubles we found that the cost per ton of coal as finally delivered in the bin by our methods was more than was being asked by local coal dealers. Consequently we were authorized to make a trial contract at one location at which the number of heated buildings was large but widely separated.

After contracts were signed with the low bidder, a local coal dealer, for a season's supply, we were practically relieved of the fuel-supply responsibility. The results of the trial showed that: (1) The section gang, which a year before had gaged considerably less track than its neighbors because of having to handle coal, had kept up its work program; (2) work-train expense had been lowered considerably; and (3) the number of loaded car-days of company material had been reduced to a figure never before attained.

On the basis of results obtained from this trial contract, other contracts were let, the performance of which has never been unsatisfactory. However, conditions at some points were such that satisfactory and economical fuel deliveries could be made by truck. At first we hired dump trucks for this purpose, but now have our own. These methods eliminated the sight, on our railroad, of a car of company coal being under load for several weeks while it is shipped from station to station.

Runoff Elevations on Curves

When establishing elevations on the runoff of a curve, using string-line notes, at what point should the full elevation be located—at the last station where the ordinate is less than the ordinates of the simple curve; at the station where the first full ordinate is obtained, or at the second full ordinate? Explain.

Extend Runoff for Comfort

By W. H. Lord

Assistant Division Engineer, Nashville, Chattanooga & St. Louis, Chattanooga, Tenn.

As the elevation, theoretically, should be proportional to the degree of curve at all points of the spiral, the elevation of the outer rail should start at the beginning and reach its maximum at the point where the spiral connects with the circular curve.

When taking string-line notes from tangent to curve, the point at which there is no ordinate is in the middle of the string while it is still on the tangent. Therefore, the spiral should start at the forward end—that toward the curve—of the string, or at the first station beyond that with the zero reading. Similarly, at the point at which full ordinate reading first occurs, it is evident that the spiral ends at the station where the rear end of the string is held. Thus, the length of the spiral is two stations less than the distance between the points at which the zero and full ordinate readings are obtained. It would seem natural to make the runoff the length of the spiral itself, but in practice it has been found better to make the runoff begin at the zero ordinate station and extend to the first station with full ordinate reading.

If cars and engines were very short with a wheel rigidly fastened to each corner (somewhat like the "Toonerville Trolley"), or if they are considered to be huge balls about 10 ft. in diameter, they would be balanced with a runoff the same length as the spiral. However, the cars and engines are not rigidly fastened to the wheels, and they are long—about two rail lengths in the case of passenger equipment—and have lost motion that permits the bodies to sway laterally until they rest firmly on their bearings on one side or the other.

The object in starting the elevation

about one rail length before the front wheels begin to take the curve is to take up this lost motion. If this is not done, the body of the car will tend to continue in a straight line until it has used up all the play and then it will start suddenly, with a jerk, to follow the curve, and will sway back and forth, more or less.

In a similar manner, at the end of the spiral, the swinging of the front end of the car will suddenly stop increasing, and, after a few sways, will settle down to a uniform motion while traversing the uniform portion of the curve. In the opposite direction, the same irregularities in motion will occur while leaving a curve through a descending spiral.

If the lost motion is taken up when the front trucks enter the spiral with the rear trucks on level track, and is eased off while the rear trucks are on the spiral and the front trucks on the body of the curve, the swaying of the car body is reduced considerably. Of course, since no two cars or engines act exactly alike, being of different length, with centers of gravity at varying heights, there can be no perfect balance of forces. Also, the speed of the train is seldom exactly that for which the curve is elevated.

The prime importance of a spiral is to provide a place in which the outer rail can be elevated gradually from level to full value, to balance, as well as possible, a tendency of the equipment to overturn. The rate of elevation increase is more important to the comfort of passengers and the wear and tear of passing equipment. The spiral may be much shorter than the runoff and give equally satisfactory results. Trackmen discovered many years ago that complaints of rough riding of spirals could often be stopped by making the runoff slightly longer than the spirals. However, if too long, the portion on the tangent and that on the regular curve will cause swaying to start again at those places. It would seem that half a car length should be about the right average. The length of a passenger car is about the same as that of the usual chord length, or two rail lengths, when string lining, so that one station before and one after the spiral would appear about right.

Comfort of passengers being the chief reason for the longer runoffs, a passenger car is mentioned above, and used as a basis. If freight cars and engines were built and kept with the close clearances of passenger cars, the above length might be too long, but they usually have far more lost motion to be used up and ride equally well. There is a saving in rail wear also since the first two outer rails of a spiral, and the last two rails, will be found usually to have more curve wear than the rest of the spiral and the rails on the main body of the curve, when the runoff is the same length as the spiral.

Don't Be Misled by Notes

By J. E. Chubb
Assistant Division Engineer, Pennsylvania, Baltimore, Md.

The theoretically correct location for the full elevation is at the last string line station where the ordinate is less than the ordinate of the simple curve. This is not a matter of opinion, but a question of simple arithmetic and is based on the following principles of spirals and run-offs: (1) The use of a cubic spiral in which the curvature varies regularly along the track from zero at the last point on the tangent to full curvature at the first point on the simple curve; (2) a run-off in which the elevation increases regularly from level at the last point on the tangent to full elevation at the first point of full curvature.

One very common mistake in dealing with string-line notes is made by those who think that the ordinate at any station indicates the curvature at that station. This is not true. The ordinate at any station indicates the average curvature of the track between the two adjacent stations, i.e., the average curvature throughout the length of the string.

Since the ordinate which is read at the point of full curvature does not tell you the curvature at that point, but rather, the average curvature throughout the length of string, one-half of which is on the spiral, it is theoretically less than the maximum.

To explain this, a table is attached showing information for a theoretically correct spiral on a one-degree curve having an elevation of 2 in. in which the rate of change in elevation is ¼ in. per 31-ft. station. This table follows.

Sta. No.	Degree of Curve in min.	Degree of Curve in 1/16 deg.	Ord.	Elev.
0	0	0	0	0
1	0	0	½	0
2	7½	2	2	¼
3	15	4	4	½
4	22½	6	6	¾
5	30	8	8	1
6	37½	10	10	1¼
7	45	12	12	1½
8	52½	14	14	1¾
9	60	16	15½	2
10	60	16	16	2
11	60	16	16	2

It can be mathematically shown that the average curvature between Stations 8 and 10 is 15½ sixteenths of a degree. If the first station of full elevation is established at the first full ordinate of curvature at Station 10, then a condition exists in which the track has full curvature—at Station 9—with less than the prescribed elevation.

Attention is called to the fact that the above notes comply strictly to specifications requiring that the full elevation be established at the point of full curvature, even though the notes may mislead one into thinking otherwise.

Put at Last Before Full

By C. I. Van Arsdalen
Division Engineer, Illinois Central, Carbondale, Ill.

We have found that the full elevation should be located at the last station at which the ordinate is less than those on the simple curve. If a string is stretched between the last station on the spiral and the first station on the circular curve its middle will be at the point of spiral curve commonly designated S. C. An ordinate measured with the string held in this manner will be less than the ordinates obtained on the simple curve itself.

Now if the string is moved forward toward the curve so that one end is at the S. C. and the other at the second station beyond on the simple curve, an ordinate measured at its center will be the first full ordinate on the simple curve. This proves, what is already known, that the simple curve extends from the S. C. forward to the C. S.

Since it is at the S. C. that we want full elevation, we then place this full elevation at the last station where the ordinate is less than those on the simple curve.

Explains by Example

By M. B. Allen
Division Engineer, Nickel Plate, Frankfort, Ind.

In my opinion, this is most clearly explained by an example. The string line-notes for a spiral 155 ft. long (5 stations) on a 3-deg. curve would be 1, 6, 12, 18, 24 and 29 tenths of an inch. The first ordinate equals 1/6 of the rate of progression of the remaining ordinates in the spiral. The final ordinate is that of the simple curve less 1/6 of the rate of progression. Please note the attached table. There is no ordinate at Station 2 because Stations 1, 2 and 3 are on a tangent and therefore in a straight line. The

ordinate at Station 3 is one and the spiral begins at this station.

Sta.	Ord.	Elev.
1	0	0
2	0	0
3	1	0
4	6	
5	12	
6	18	
7	24	
8	29	Full
9	30	"
10	30	"

The ordinate at Station 8 is 29 and this is the end of the spiral. All of the curve between Station 8 and Station 10 has an ordinate of 30 and, therefore, is beyond the end of the spiral.

Zero elevation in this example would, therefore, be at Station 3 where the first ordinate occurs, and full elevation would be obtained at Station 8 where the last spiral ordinate is located. This location of zero-elevation point and full-elevation point is true regardless of the degree of curve or the length of spiral used.

Use First Full Ordinate

By G. B. Harris
Assistant Engineer, Chesapeake & Ohio, Richmond, Va.

The elevation of the outer rail on curves should increase at a uniform rate, from zero at the beginning of the spiral (PTS) to the required or full elevation at the end of the spiral or beginning of the circular curve (PSC). In other words, the full elevation should be reached at the station having the first full ordinate.

Since the elevation is a function of the degree of circular curve, it follows that if the full elevation is reached at the station where the second full ordinate is located, then the elevation at the station behind, or the station where the first full ordinate is located, is less than that required for that ordinate. By the same token, if the full elevation is located at a station before the full degree or full ordinate is reached, then the elevation at that station is more than required.

The spiral or easement curve serves a double function. It is a gradual means of transition from a straight line or tangent to the full degree of curvature and also serves as a runoff between the level tangent track and the fully super-elevated curved track.

The mid-ordinates of the chords in the spiral should increase as the distance from the beginning of spiral increases until the full degree of curve is reached and the elevation should increase in a similar manner. By following this rule the correct elevation will be located at all points on the spiral.

Shelters at Outlying Switches

Should some form of shelter be provided for the use of men assigned to keep outlying switches clear during winter storms? If so, under what conditions? What type is best adapted?

Climate Governs Necessity

By District Maintenance Engineer

Physical and climatic conditions, as well as traffic requirements, dictate the necessity for assigning men to outlying switches during winter storms and also the desirability of providing shelter to protect these men. It is generally considered necessary to afford no shelter protection at hand-throw switches as these locations are usually cleared by a gang operating over a section by motor car or other means of transportation.

Power-operated switches in C.T.C. territory, switches at some distance from an interlocking plant, but operated by switch machines from this plant, and spring switches, require more attention, and assignment of men during storms is essential if traffic is to continue to move with minimum delay.

Geographical location generally influences the severity of winter storms and this, in turn, dictates the necessity for men and shelter. In areas where winter storms are of short duration and temperatures moderate, shelter should not be necessary, but in northern latitudes this requirement becomes essential. Conditions on individual railroads dictate the type of shelter required and no standard of construction can be set up to apply in all situations.

However, in the northern portion of the United States and much of the mountainous section, a substantial shelter equipped with stove, telephone and call bell or light is usually provided. This structure complies with the building standards of the individual railroads and the number of men to be assigned to a particular switch will govern its size. Prevailing temperatures and duration of winter storms dictate the type of construction. The call bell or light, mounted on the outside of the shelter, is installed to permit the dispatcher to check on men and conditions as necessary.

Shelters Are Desirable

By Roadmaster

A shelter is desirable and should be provided for both the section men and signal maintainers assigned to keep outlying main-track switches open during and after a severe snow fall or blizzard. The shelter should be of a type characteristic of other buildings in the territory involved and large enough for a suitable stove and bench. It should also be furnished with an electric light and telephone, although the latter may not be absolutely necessary. Many of our railroads in isolated C.T.C. territory have already seen the necessity of providing such shelters as a safety measure for the men and to keep down adverse criticism, especially where the men are obliged to stay on the job until relieved in severe weather. Where there are only one or two switches to be kept open, a standard frame watchbox building having inside dimensions of about 7 ft. 8 in. by 9 ft. 2 in., and having two windows, a caboose stove and a combination coal box and seat should be ample. Where there are a number of switches at an outlying location, and the services of a signal maintainer are required, a standard frame building having inside dimensions of 8 ft. by 14 ft. and containing several windows, a caboose stove, a sufficient number of benches and a coal box should be furnished. Also, one or two lockers should be provided for the use of the signal maintainer. If the building can be serviced with electricity at reasonable expense, a floodlight for lighting up switches could be used to advantage as a safety measure.

In yards, as a rule, a shelter of some kind is available where the force is provided with heat. Suitable stoves are also provided in each section toolhouse for the convenience and comfort of men during cold weather. This policy is followed because our management believes that by keeping the force comfortable and satisfied during lunch periods and inclement weather, increased efficiency will result.

In many instances in the changing of facilities it is possible to move existing buildings to any locations desired. These buildings are provided with the tools, supplies and equipment required to clean and make minor repairs to the switches, and are kept in these shelters during all the winter months. Cleaning switches during the winter months in outlying districts should be carefully programmed. Auxiliary facilities, such as oil heaters, gas heaters, air, or other mechanical means of removing snow should be provided, when possible, to avoid an excessive use of manpower.

PRODUCTS OF MANUFACTURERS

New, improved equipment, materials, devices

(For additional information on any of the products described in these columns, use postcards, page 1127)

Machines for Cleaning Flangeways

THE Woolery Machine Company, Minneapolis, Minn., has developed two new power-operated units for cleaning snow and ice from the flangeways at highway-railway grade crossings to eliminate slow and expensive hand methods. One of these is a small, one-man, off-track unit, which cleans the flangeway along one rail at a time and is well adapted for use about stations. The other, for use on more widely-scattered crossings, is a self-propelled on-track machine which cleans both flangeways at the same time.

The Off-Track Unit

The smaller unit consists of a 4-hp., air-cooled engine mounted on the axle between two pneumatic-tired roller-bearing wheels; a V-belt-driven circular cutter with four cutting blades; a shoe which slides on the rail just behind the cutter, supporting the rear end of the unit and gaging the cutting blade to the desired flangeway depth; and two handles at the rear of the machine by means of which the machine is guided by the operator. In operation the machine is guided along the track just inside or outside the rail with the cutter lowered in the flangeway at the desired depth. As the cutter rotates, the loosened ice and snow is thrown against a steel guard and chute mounted over the cutter and is deflected away from the flangeway.

The cutter blades, 1½ in. in size, can be easily removed for sharpening if necessary. Adjustments can be made for three cutting depths—1¼ in., 2¼ in. and 3¼ in. Standard equipment includes a head light, two tail lights and a 6 to 8-volt generator. The machine weighs 244 lb.

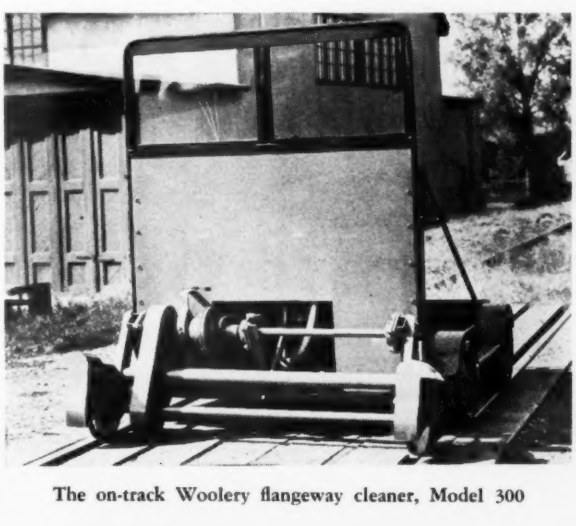
The On-Track Machine

The on-track unit, known as Model No. 300, consists of a flangeway-cleaner attachment mounted on the front of a section-crew size motor car. The cleaner attachment is comprised of two circular cutters, one mounted above the flangeway of each rail. The two cutters are clutch-driven from the motor car engine. With this machine, upon approaching a crossing, the speed of the motor car is reduced to 2 m.p.h. and the cutters are lowered into the flangeways by a hand lever. The clutch is then engaged, causing the cutters to revolve at a speed of 1,800 r.p.m., loosening the snow and ice which is deflected away from the flangeways by steel guards and chutes mounted over the cutters. Upon reaching the other side of the crossing, the cutters are raised by the same hand lever and the clutch disengaged. The car is then ready to move quickly to the next crossing. The entire flangeway attachment can be removed by taking out six bolts and the car then used for regular section work.

The motor car is powered by a 10-hp., 4-cycle air-cooled engine with a 2-speed transmission, either forward or reverse, and a 4-wheel drive. The all-welded frame of the car is made of angle and channel steel sections. The body panels completely enclose the engine, lift handles and moving parts. The top is constructed in one piece, and may be removed to give access to any part of the car. The motor car is light enough, it is said, to be lifted on or off the track by one man, yet large enough to carry six men.

A special feature of the car is the axle arrangement. Instead of one-piece axles between pairs of wheels, each axle of the Woolery Model 300 is divided into two pieces. For each car, therefore, there are four half

The small Woolery flangeway cleaner



The on-track Woolery flangeway cleaner, Model 300

axles, which, with wheels and bearings, are identical and interchangeable. The transmission is placed between the inside ends of the half axles, driving each half through a hardened-steel splined sleeve which engages the splined ends of the half axles. Power transmission by this means is said to eliminate radial loading due to belt or chain pull. When removing the car from the track, a jaw clutch is released, allowing a differential wheel action at either end of the car. The new axle arrangement, along with four-wheel drive and selective transmission, is said to provide greater traction with less wheel wear, and to reduce the weaving action of the car regardless of the direction of travel of the car.

Push-and-Pull Jacks

A Simplex Cramer-type push-and-pull jack for lining piles and for other types of push-and-pull jacking work has been announced by Templeton, Kenly & Co., Chicago. Two stock models are available—Model 5 and Model 6.

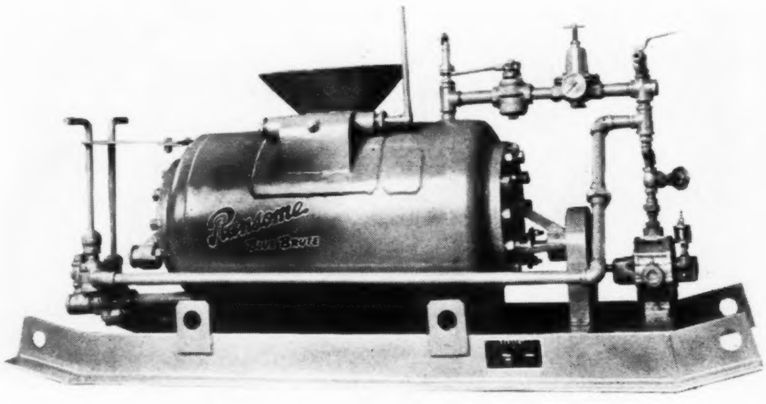
The jack is operated by a lever with a pawl which turns a rachet, causing a screw to shorten or extend as desired. Each end of the screw contains a curved bearing plate for pushing work and lugs for a chain on jobs requiring a pulling operation. To assure a firm grip and eliminate slipping on pushing jobs, a V-edged circular protrusion is provided on each bearing plate. The jack features screws of precision-cut acme threads.

Lining piles with the new Simplex push-and-pull jacks

Model No. 5 is 11 in. long (closed position), extends to 17 in. and weighs 34 lb. Model No. 6 is 18 in. long (closed position), extends to 30 in. and weighs 42 lb. Both models have a screw diameter of 1¾ in. and a rated capacity of 12 tons. Jacks of longer lengths are available on special order.

Grout Mixer-Ejector

THE Ransome Machinery Company, Dunellen, N.J., a subsidiary of the Worthington Pump & Machinery Corp., has recently placed on the market a new Blue Brute grout mixer-ejector which has been designed to meet the specialized requirements of railway roadbed-grouting operations. Light in weight and portable, this unit is designed for working pressures up to 100 p.s.i., and is equipped with an air motor for driving the mixing paddles, thus making it completely air operated.



A Ransome Blue Brute grout mixer-ejector

The entire unit is skid mounted and embodies a mixing chamber, complete with charging hopper and safety valve, the air motor and the necessary piping. The chamber has a capacity of 4½ cu. ft. of mixed grout or 6 cu. ft. of dry material. A by-pass line is provided for use in blowing water or dirt out of the work or for cleaning clogged hose lines without disconnecting the mixing chamber from the compressor.

The charging door is so designed that it is sealed by air pressure when the unit is operating, reducing the possibility of accidents. When the pressure is released the door opens automatically. Mixing of the grout is accomplished by paddles operating on a shaft mounted in outboard bearings so that grout leaking through worn packing will not damage the bearings. The drum heads of the mixing chamber are removable to facilitate inspection of the entire paddle shaft.

Discharge of grout from the chamber is through a round-way cock, assuring full-area discharge. It is claimed that a 60-cu. ft. compressor is adequate for straight grouting operations, but where air tools or other accessories are used, the manufacturer recommends the use of a 105-cu. ft. compressor to provide reserve capacity.

As furnished, the unit is reported as being capable of handling a wide range of grout consistencies without special apparatus or adjustment. A complete line of grouting accessories is available for use with this unit.

One-Man Hoist

THE American Gage & Manufacturing Co., Dayton, Ohio, is introducing a one-man hoist, called the Pow'r Pull, which, while weighing only 6 lb., is said to have a capacity of 1,500 lb.

(For additional information on any of the products described on this page, use postcards, page 1127)

with 50 per cent overload. It can be used either in a vertical or in a horizontal position on any pulling job where a chain hoist or block and tackle are now used.

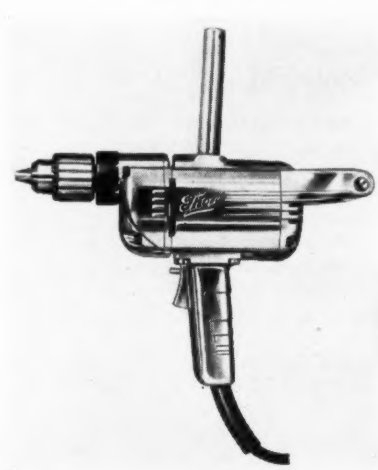
The new unit consists of a cable drum with rachet mounted in the center of a frame which contains at one end a permanently-attached swivel hook, and at the other end an eye through which the cable leading to the drum is threaded. The power is applied by engaging the teeth of the rachet with a pawl on a lever, the fulcrum of which is the axle of the drum. The power ratio is 14 to 1. The materials used in the manufacture of the hoist include high-tensile manganese bronze, aluminum bronze, navy bronze, aircraft cable and cadmium-plated steel.

This new one-man hoist, while weighing only 6 lb., is said to have a capacity of 1,500 lbs.

Electric Drill

THE Independent Pneumatic Tool Company, Aurora, Ill., has announced a portable electric ½-in. drill, known as the Thor "Silver Line," featuring high power with light weight, and an improved ventilating system which is said to maintain a cool surface temperature during continuous heavy-duty operation.

The new drill has a highly-polished die-casting case, a free speed of 500 r.p.m., ball-bearing construction throughout, a removable dead handle, steel bearing inserts, a removable switch handle, precision gearing and a three-jaw Jacobs key-type chuck. The drill is 11 in. long and weighs 7 lb.



The new Thor "Silver Line" ½-in. drill

Jack for Low-Set Loads

THE Duff-Norton Manufacturing Company, Pittsburgh, Pa., has announced a new ball-bearing screw jack, called the "Shorty", for lifting low-set loads. The unit is 7 in. high, weighs only 22 lb., and has a capacity of 15 tons. While of the same height as the Duff-Norton No. 1007 jack, the "Shorty" has a capacity 5 tons greater and utilizes a ball thrust bearing instead of a pintle bearing.

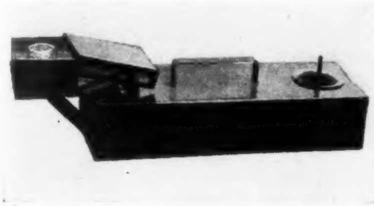
The Duff-Norton "Shorty" jack is 7 in. high, weighs only 22 lb. and has a capacity of 15 tons

The new jack housing is made in one piece of malleable iron, and the ram is of seamless tubing with a bronze nut. The screw is heat treated and is fitted to the gear which is supported on the ball thrust bearing. The gears are machined, cut and heat treated. The unit is operated by a 1⅛-in. by 36-in. pinch-bar lever.

Switch Heater

The Rails Company, New Haven, Conn., is now offering a new model kerosene-burning switch heater which is said to have the advantages of small size, long burning, low fuel consumption and improved combustion. Known as Type D, this heater embodies a fuel tank 5½ in. by 15 in. by 3 in. deep, with a flame box projecting beyond and above one end of the tank. A tube, filled with wicking, extends between the tank and the flame box. The total height of the burner is 5⅛ in.

Within the flame box is a mixing chamber of perforated sheet metal shaped in the form of a truncated cone with an open top. The exposed end of the wicking is at the bottom of the chamber, and the perforations, together with air intakes in the bottom of the flame box, are said to insure vaporization of the fuel and to result in complete combustion, with minimum carbon and with consequent increase in the quantity of heat that is conducted to the rail. The flame box also serves to confine the flame laterally, thus protecting the ties. A sliding cover is attached to the flame box and serves as a snuffer to extinguish the flame.

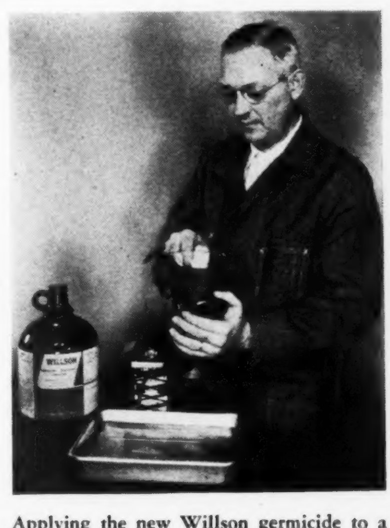


The Rails Company Type D switch heater

It is claimed that the Type D heater can operate continuously for a minimum of 50 hr. on a gallon of fuel. The small size of this units permits it to be installed with a limited amount of cribbing. A convenient handle is provided for carrying the heater.

New Germicide for Equipment Sanitation

WILLSON Products, Inc., Reading, Pa., is now offering a new germicide for sterilizing personal safety equipment such as gas masks, goggles, weld-



Applying the new Willson germicide to a safety device

(For additional information on any of the products described on this page, use postcards, page 1127)

er's masks, respirators, safety shoes or any washable apparel, which thereby protects workers from contamination through the use of such devices.

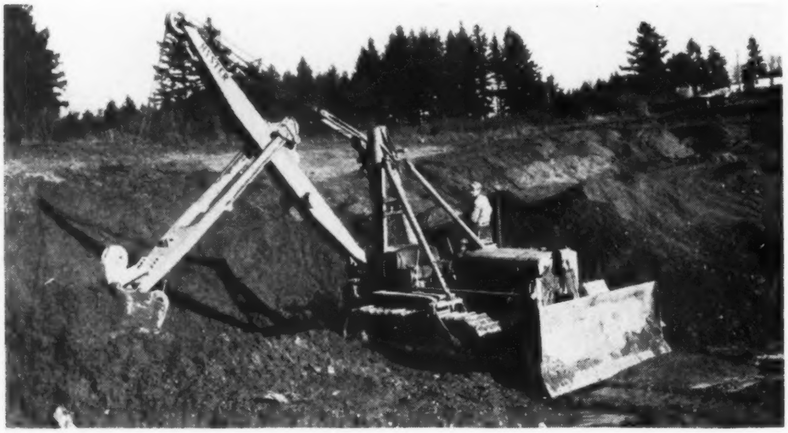
The new product is a practically odorless solution, which is said to be non-corrosive, non-staining, non-poisonous and non-irritating to the skin. It is claimed to be about 25 times more effective as a germ-killing agent than carbolic acid. In addition to its germ-killing action, the solution acts as a deodorant and fungicide.

The new germicide may be used as a spray, swabbing solution or immersion solution. It is said to be effective in hot or cold water in the recommended concentration of two teaspoonfuls to a quart of water, but users are cautioned not to mix the solution with soap.

Shovel and Hoe Added to Hystaway

THE Hyster Company, Portland, Ore., has developed shovel and hoe attachments for application to its Hystaway unit (as mounted on Caterpillar crawler tractors). As a result, according to the manufacturer, the one machine now incorporates all of the features of a bulldozer, dragline, clamshell, crane, shovel and hoe. The new attachments, both of which are equipped with ESCO buckets, can be installed, it is said, without major alterations to existing machines.

The new shovel and hoe fronts are each available in one size only, the shovel being somewhat larger in size than, and the hoe about the same size as, the average ½-yd. conventional unit. The standard bucket width on the hoe front, including side cutting teeth, is 33 in., but buckets of special widths are available upon request. A dipper trip drum is included with the shovel attachment and can be installed on the hoist without replacing any major parts. The drum, it is said, does not interfere with dragline, crane or hoe operations and may be left in place permanently. The new shovel and hoe may be used on Caterpillar D8 and D7 tractors. They are not, however, recommended for installation on the D6 model because of the length of the boom.



A Hyster Hystaway equipped with one of the new shovel attachments

New Tournapull for Small Yardage Projects

R. G. LE TOURNEAU, Inc., Peoria, Ill., has added to its line of earth-moving equipment a new Tournapull, called the Model D Roadster, designed especially for use on jobs where the amount of material to be moved is relatively small. The new unit is said to be well adapted for earth moving on many railroad construction and maintenance projects such as the construction of subgrades for sidings and spur tracks, cutting and cleaning drainage ditches, cut and embankment widening and grading, and similar work. The new Tournapull, powered by a 100-hp. Diesel or gasoline engine and mounted on 14-by-32 tapered-bead tires, travels at speeds up to 25 m.p.h. It is used with the E-9 Carryall scraper, a unit with a capacity of 7 cu. yd. or 9 tons.

The Model D Roadster Tournapull in operation

Important features of the unit include complete control of all steering and scraper operations by individual electric motors, a torque-proportioning differential which automatically supplies power to the wheel on the firmest footing, and multiple-disc air brakes. The wheels are set inside the cutting edge of the blade, a feature which enables the machine to work closely along banks or in ditches. The Model D Roadster is 27 ft. 10¾ in. long, 8 ft. wide, 8 ft. 6¾ in. high (with cab), and weighs 20,700 lb. The width of the cutting edge of the blade is 7 ft. The entire unit can be turned within a radius of 19 ft.

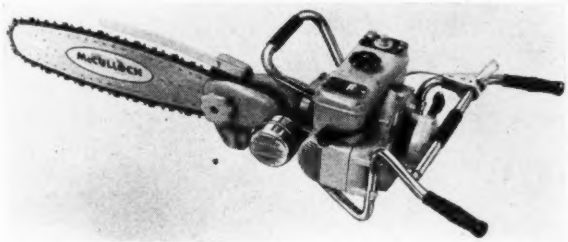
New Chain Saw

A NEW lightweight chain saw with an all-purpose chain for either ripping or cross cutting has been announced by the McCulloch Motors Corporation, Los Angeles, Cal. The power unit is a 5-hp., 2-cycle McCulloch engine with a built-in gasoline tank and a beveled-gear transmission. The cutting unit is composed of a stainless-steel laminated blade and the cutting chain. The saw is equipped at one end with a pair of bicycle-type handle bars and two cross bars for one-man operation. The opposite end of the saw is fitted with an auxiliary handle for two-man use. The auxiliary handle is detachable.

(For additional information on any of the products described on this page, use postcards, page 1127)

The engine is started by a recoil starter designed in such a manner, it is said, that it cannot kick. Engine speed is controlled either by a thumb throttle on the right handle bar or by twisting the cross-bar grip. Other engine controls are grouped conveniently on a panel above the gasoline tank. The carburetor, of the diaphragm type, permits the engine to be operated in any position.

The principal features of the power transmission system include an automatic clutch and a full 360-deg. swivel. At idling speed the clutch disengages, stopping the motion of the chain. To start sawing it is necessary only to open the throttle. Furthermore, the clutch is said to prevent engine stalling if the chain becomes jammed in a cut. The 360-deg. swivel permits sawing at any angle while holding the saw in the position that is most comfortable for the operator.



Left—One of the new McCulloch chain saws with a 20-in. blade

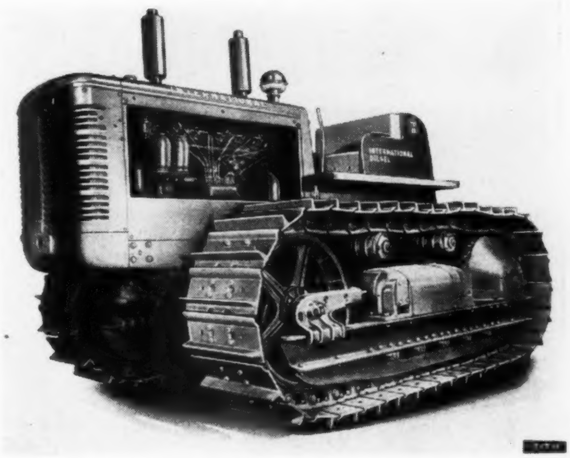
It is said that the chain has no critical wear points and can be easily sharpened in the field by an unskilled operator without removing it from the blade. The saws are available in blade lengths of 20 in., 36 in., 48 in. and 60 in. Each saw is provided with a full-length guard.

More Power for Crawler Tractor

THE Industrial Power Division, International Harvester Company, Chicago, has announced that the power rating of the six-cylinder International TD-18 Diesel crawler tractor has been increased as a result of new designs for the cylinder heads, manifolds, and the fuel system. At an engine speed of 1,300 r.p.m., the horsepower ratings of the new TD-18 are now as follows: Flywheel, 97; belt, 91.5; and drawbar, 80.5. The compression ratio is 15½ to 1.

The new design of the cylinder heads is reported to provide better cylinder head cooling. The intake and exhaust manifolds have been mounted on opposite sides of the engine. This arrangement provides a direct flow of intake air and exhaust gases, thereby, it is said, improving engine-breathing efficiency. Furthermore, as a result of the separation of the manifolds, the volumetric efficiency of the intake air is increased, it is claimed. Since, under this arrangement, the intake air is not pre-heated by the exhaust manifold, it retains its maximum atmospheric density while being drawn into the cylinders.

The new fuel system is claimed to deliver accurately-metered, equal quantities of fuel to each cylinder in accordance with the needs of the engine. The injection pump has two plungers, each serving three cylinders. These plungers may be easily and economically replaced. The injection nozzles are of the single-orifice type. They are set, with the precombustion chambers, into the cylinder head at an angle, a feature which is said to promote complete combustion of low-grade fuels. The injection pump has a quick-acting, variable-speed governor with torque control. When the engine is working against an overload, the torque control causes more fuel to be injected into the cylinders.



The improved International TD-18 crawler tractor

Line Marker

THE Universal Manufacturing & Sales Co., South Gate, Cal., has announced a new portable device, known as the Mark-Rite Junior, for use in marking lines, for reasons of safety and appearance, at locations where the area to be covered is relatively small. It can be used also for lettering a variety of simple pavement signs. The lines are painted by pushing the device by means of a handle over the surface to be marked at a walking speed. The brushes, which are made of hog bristles, may be replaced when necessary. Of all-metal construction, the line marker weighs 3 lbs. complete. It is said to be easily cleaned when necessary by flushing the container, valve and brushes with either gasoline or thinner.

The new Mark-Rite Junior line marker

(For additional information on any of the products described on this page, use postcards, page 1127)

THE MONTH'S NEWS

Happenings among the railways—the associations—the suppliers

Changes in Railway Personnel

General

K. E. Stephenson, assistant division engineer on the Chesapeake & Ohio, at Ashland, Ky., has been appointed assistant trainmaster, with headquarters at Peru, Ind.

John Edwards, Jr., general superintendent of transportation of the Baltimore & Ohio at Baltimore, Md., and an engineer by training and experience, has been appointed general manager of the Central region at Pittsburgh, Pa.

Engineering

F. E. Morrow, whose retirement as chief engineer of the Chicago & Western Indiana and the Belt Railway of Chicago, with headquarters at Chicago, was reported in the October issue, was born at Kokomo, Ind., and was graduated from Purdue university in 1904 with a Bachelor of Science degree in civil engineering. He began his railway career in that same year in the engineering department of the Chicago & North Western, and during the years 1907 to 1910 he was field engineer with the Chicago surface lines. In April, 1910, he joined the Chicago & Western Indiana as office engineer, advancing to principal assistant engineer in 1913 and assistant chief engineer of both the C. & W. I. and the Belt Railway of Chicago in 1915. Mr. Morrow has served as chief engineer of the two roads since 1918.

F. E. Morrow

V. R. Walling, whose promotion to chief engineer of the Chicago & Western Indiana and Belt Railway of Chicago, with headquarters at Chicago, was noted in the October issue, was born on May 24, 1880, at Tripoli, Iowa, and was graduated from the University of Kansas in 1901. In June, 1901, he entered railway service at a draftsman for the Cananea Consolidated Copper Company's railway at Cananea, Sonora, Mex. Mr. Walling subsequently served as instrumentman with the Southern Pacific, and held various positions with the former company until 1912, when he joined the C. & W. I. as assistant engineer at Chicago. In 1915 he was appointed principal assistant engineer in charge of construction, track elevation and maintenance, and in 1933 he was promoted to engineer maintenance of way for the C. & W. I. and the Belt Railway. From 1940 to 1944 he served as superintendent of the C. & W. I., advancing in the latter year to assistant chief engineer of the two roads. Mr. Walling was serving in the latter postion at the time of his recent appointment as chief engineer.

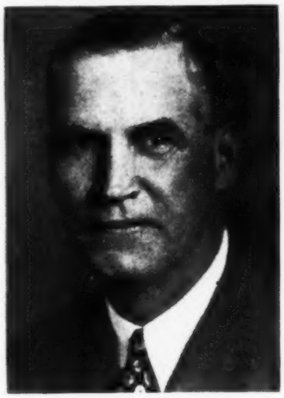
V. R. Walling

Willis E. Hinman, assistant engineer of the New York Central, with headquarters at New York, retired recently.

W. Y. Ware, division engineer on the Gulf, Colorado & Santa Fe, with headquarters at Temple, Tex., has been appointed construction engineer, with headquarters at Galveston, Tex.

L. H. Miller, formerly supervisor of track of the Pennsylvania at Altoona, Pa., has been appointed engineer of the Akron & Barberton Belt, with headquarters at Barberton, Ohio.

Arthur B. Hillman, whose promotion to assistant chief engineer of the Chicago & Western Indiana and the Belt Railway of Chicago, with headquarters at Chicago, was reported in the October issue, was born on September 24, 1889, at Chicago. He was graduated by the University of Illinois in 1914, some five years after entering railway service with the Lake Shore & Michigan Southern (now part of the New York Central System). He subsequently served as chainman and rodman with the latter road, and in 1910 he joined the C. & W. I. as a rodman. He advanced through successive positions as levelman and transitman, and in 1916 was appointed assistant engineer maintenance with the Belt Railway of Chicago. Following army service as an officer in World War I, Mr. Hillman returned to the Belt Railway in 1919 as assistant engineer, serving later as roadmaster, assistant trainmaster and assistant engineer maintenance. In 1930 he was appointed roadmaster, with jurisdiction over the bridge and building department, and in 1937 he became assistant engineer in charge of reconstruction of Clearing yard. Mr. Hillman was further advanced in 1940 to engineer maintenance of way of both the Belt Railway of Chicago and the Chicago & Western Indiana, which position he was holding at the time of his recent promotion to the position of assistant chief engineer.

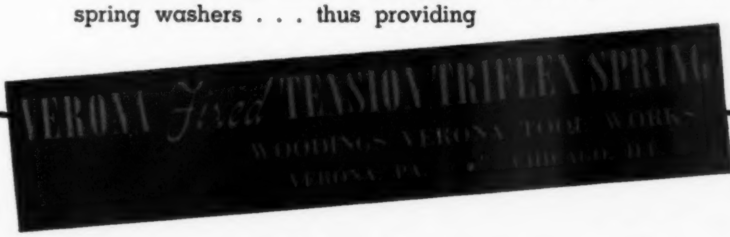


Arthur B. Hillman

(Please turn to page 1198)

THE WORLD'S *Finest* SPRING WASHER

There are two indisputable facts about the VERONA *Fixed* TENSION TRIFLEX SPRING: One: It has the *highest reactive value* in the entire field of spring washers . . . thus providing a higher bolt tension over a given period of time. Two: It has a "built-in tension gauge" to indicate the *equal* and *proper* tension on all bolts.



The RAILROAD HOUR
ABC NETWORK • Monday Nights

Railway Personnel (Cont'd)

Harry C. Minteer, whose promotion to division engineer on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Terre Haute, Ind., was reported in the August issue, was born at Chicago on January 5, 1911, and received

Harry C. Minteer

a Bachelor of Science degree in civil engineering from Purdue university in 1935. He entered the service of the Milwaukee on Novmber 6, 1939, as a rodman in the division engineer's office at Milwaukee, Wis., being transferred to Chicago in June, 1940. In November of that year he was appointed instrumentman at Savanna, Ill., and in April, 1941, he was granted a leave of absence to enter military service, serving as a major with the field artillery in Europe until November, 1945, when he returned to the Milwaukee. In April, 1947, Mr. Minteer was appointed assistant engineer at Savanna, and was promoted to assistant division engineer at that point in August, 1947. He was transferred to Terre Haute in November of that year, and was stationed there at the time of his recent appointment as division engineer.

A. E. Haywood, assistant engineer of the Grand Trunk Western's Chicago division, has been appointed assistant engineer maintenance of way, with headquarters at Detroit, Mich.

William J. Shaw, division engineer of the Canadian division of the Michigan Central, with headquarters at St. Thomas, Ont., retired recently after 47 years service.

S. Blumenthal, senior assistant engineer in the chief engineer's office of the Canadian Pacific at Montreal, Que., retired recently after 43 years service with that company.

P. R. Matthews, supervisor of track on the Chesapeake & Ohio, at Columbus, Ohio, has been promoted to assistant division engineer, with headquarters at Ashland, Ky., succeeding **K. E. Stephenson,** whose appointment as assistant trainmaster is noted elsewhere in these columns. **R. J. McCarren** has been appointed assistant cost engineer, with headquarters at Hopetown, Ohio.

John E. Chubb, whose promotion to assistant division engineer of the Maryland division of the Pennsylvania, with headquarters in Baltimore, Md., was announced in the August issue, was born in Edgewood, Pa., on July 12, 1912. He graduated from Ohio State University in 1935 and, on June 20 of that year, entered the service of the Pennsylvania as a trackman on the Columbus division. On August 29 of that year he became engineer apprentice on the Middle division, at Lewistown, Pa., and later served at Baltimore, Huntingdon, Pa., Johnstown, Pa., and on the Eastern Region rail train. Mr. Chubb was promoted to assistant supervisor of track at Buffalo, N.Y., on May 10, 1937, and subsequently was assigned to Enola, Pa., Wilmington, Del., and Philadelphia, Pa. He became supervisor of track at Cincinnati, Ohio, on February 15, 1942, and was transferred to New York on November 16, 1944.

R. H. Menary, whose appointment as assistant division engineer of the Canadian National, with headquarters at London, Ont., was announced in the August issue, was born on June 3, 1918, at Hamilton, Ont. He attended Queens University, Kingston, Ont., from 1938 until 1941. In April, 1941, he was employed by the Auglin-Norcross Construction Company as a rodman and subsequently advanced through the positions of instrumentman and assistant engineer. In April, 1944, Mr. Menary entered the service of the Canadian National as an instrumentman and in August, 1946, was promoted to acting assistant to the division engineer of the Belleville division, with headquarters at Belleville, Ont., which position he was holding at the time of his recent appointment.

David W. Blair, whose promotion to division engineer of the Laurentian division of the Canadian National, with headquarters in Quebec, Que., was announced in the September issue, was born in Quebec on April 29, 1917. He attended the University of New Brunswick between 1936 and 1946, his education having been interrupted by the war, during which he served overseas in the Royal Canadian Naval Volunteer Reserves. Returning to school at the close of the war, he received a B.S. degree in civil engineering and entered the service of the Canadian National on June 3, 1946, as a junior assistant engineer in the research and development department at Montreal, Que. In April, 1948, he was promoted to assistant engineer of the Levis division, with headquarters at Levis, Que., and held that position until his recent promotion.

C. A. Roberts, chief draftsman in the structural department of the Erie, has been promoted to engineer of structures, with headquarters as before at Cleveland, Ohio, succeeding the late **A. A. Visintainer,** whose death is reported elsewhere in these columns. **B. J. Shadrake,** chief structural designer, succeeds Mr. Roberts as chief draftsman.

Mr. Roberts was born at Norwood, Mass., on March 23, 1908, and was graduated from the Massachusetts Institute of Technology in 1930 with a degree of Bachelor of Science in civil engineering. He entered the service of the Erie in July, 1930, as a junior draftsman at New York, and subsequently held the positions of draftsman and designer, working on both repairs and strengthening of existing bridges and on design of grade crossing elimination and new buildings. In April, 1945, Mr. Roberts was appointed assistant engineer, and in April, 1947, he became

C. A. Roberts

chief draftsman in the department of structures, the position he was holding at the time of his recent promotion to engineer of structures.

John E. Rogan, assistant engineer maintenance of way of the Illinois Central, with headquarters at Chicago, has retired because of ill health.

James K. Gloster, assistant engineer in the miscellaneous department of the chief engineer's office, Louisville & Nashville, at Louisville, Ky., has been advanced to division engineer at Evansville, Ind. He succeeds the late **James B. Cochran,** who died on September 16. **Eugene R. Englert,** draftsman in the Louisville office, has been promoted to assistant engineer of the Louisville division, succeeding **R. E. McLaughlin,** who has been appointed assistant engineer in the miscellaneous department at Louisville.

J. C. Aker, whose appointment as chief engineer of the Nashville, Chattanooga & St. Louis, with headquarters at Nashville, Tenn., was noted in the October issue, was born on March 9, 1889, at Delaware City, Del. He was graduated by the University of Delaware in 1908, and entered railroad service in 1910 with the Louisville & Nashville, serving in the engineer corps in various capacities on construction work in Kentucky, Tennessee and Alabama until October, 1915. He was next appointed resident engineer for the N.C. & St.L. on the construction of various grade revision projects. Following military service during World War I, he returned to the N.C. & St.L. as assistant engineer in the valuation and real estate department. From 1923 to 1927 he was employed in the maintenance of way and bridge departments, and in the latter year he became assistant engineer in the office of the chief engineer. In 1939 Mr. Aker was appointed assistant chief engineer.

(*Please turn to page* 1200)

Railway Personnel (Cont'd)

S. Cook has been appointed division engineer of the Kenora division of the Canadian Pacific, with headquarters at Kenora, Ont., where he succeeds **S. C. Wilcox** who has retired after 41 years service.

Charles F. Parvin, who has been promoted to assistant division engineer of the Philadelphia Terminal division of the Pennsylvania, with headquarters at Philadelphia, Pa., as announced in the August issue, was born in Cambridge, Md., on December 15, 1912. He attended the University of Michigan, graduating in 1934. He entered the service of the Pennsylvania on July 2 of that year as assistant on the engineering corps of the Fort Wayne division and subsequently served in that capacity on the Chicago Terminal and Columbus divisions. Mr. Parvin was promoted to assistant supervisor of track at Aspinwall, Pa., on the Conemaugh division on February 1, 1937, and later served in that capacity at Niles, Ohio, on the Erie & Ashtabula division and at Lancaster, Pa., on the Philadelphia division. He became supervisor of track on the Philadelphia division at Enola, Pa., on July 1, 1941, and was later transferred in the same capacity to the Philadelphia Terminal division, with headquarters at Philadelphia, where he remained until his recent promotion.

John P. Datesman, whose appointment as engineer of track of the Chicago & North Western at Chicago, was reported in the October issue, was born on November 22, 1897, at Douglas, Wyo., and attended Iowa State College. In 1919 he entered railroad service as a tapeman with the North Western at Sioux City, Iowa, later serving as rodman at Eagle Grove, Iowa, and as instrumentman on construction of Proviso yard. Mr. Datesman was appointed assistant engineer at Proviso in 1926 and worked in that capacity until the yard was completed in 1930. At that time he was transferred to Kenosha, Wis., as assistant engineer on track elevation work, and in 1932 he became assistant roadmaster on the Wisconsin division, with headquarters at Chicago. In 1934 he was advanced to roadmaster at Council Bluffs, Iowa, where he was located until his appointment in 1944 as drainage engineer at Chicago. Mr. Datesman was appointed division engineer at Huron, S.D., on January 1, 1947, being transferred to Green Bay, Wis., on July 1 of that year, and to Chicago on July 1, 1948, and was serving at the latter point at the time of his appointment as engineer of track.

R. C. Slocumb, assistant engineer on the Baltimore & Ohio, with headquarters at Baltimore, Md., has been appointed engineer of roadway and track, with headquarters as before at Baltimore, succeeding **J. B. Myers,** who has retired.

Mr. Myers was born on August 4, 1878, and was graduated from Pennsylvania College in 1900. Immediately after graduation he became assistant chief engineer at Meadville, Pa., and was later connected with the Pittsburgh Bridge Company. He entered the service of the B. & O. on April 1, 1901, as a rodman at Pittsburgh, Pa., and after several promotions became assistant division engineer at Pittsburgh in May, 1903, and was transferred in this capacity to Cumberland, Md., in December of that year. In August, 1907, Mr. Myers was promoted to division engineer of the Shenandoah division at Winchester, Va., and a month later returned to Cumberland as division engineer of the Cumberland division. He was promoted to district engineer maintenance of way of what was then known as the Main Line district in April, 1914, with headquarters at Baltimore, and held that position until July, 1920, when he became engineer roadway and track, the position he held at the time of his retirement.

Spencer Danby, assistant valuation engineer of the Pennsylvania at Philadelphia, Pa., has been promoted to valuation engineer, succeeding **D. O. Lyle,** who is retiring.

Mr. Lyle was born at Pomeroy, Ohio, on September 2, 1878. Mr. Lyle was graduated as a civil engineer from Ohio Northern University in 1903 and entered railroad service with the Pennsylvania lines west of Pittsburgh as a draftsman in the real estate department on April 28, 1903. Two years later he was transferred to the maintenance of way department and had charge of various construction and maintenance projects on the Marietta, Toledo, Logansport and Pittsburgh (now Panhandle) division. Since 1914 Mr. Lyle has been connected with the valuation department. In the capacity of assistant engineer he had direct charge, under the direction of the valuation engineer, of the company's participation in the inventories and cost analyses (for the Western lines) required by the Federal Valuation Act. On March 1, 1920, he was appointed assistant valuation engineer at Pittsburgh, Pa., transferring to Philadelphia in July, 1924. Mr. Lyle was promoted to valuation engineer on December 1, 1935, in which capacity he served until the time of his retirement.

Monument Erected to Honor "Tie Hacks" of Wyoming

A monument "erected to perpetuate the memory of the hardy wood and river men who worked on the operations of the Wyoming Tie & Timber Co." was recently dedicated at ceremonies near Dubois, Wyo. The memorial pays tribute to those men, known as "tie hacks", who hewed by hand millions of crossties for the railroads of the West, but whose trade has given way to sawed ties. The monument is 14 ft. high and carved from a 3½-ton block of Bedford limestone. The dedication address was delivered by Nye F. Morehouse, vice-president and general counsel, Chicago & North Western.

Track

William K. Walker, section foreman on the Louisville & Nashville, has been promoted to track supervisor at Bay Minette, Ala., to succeed **J. C. Barron,** who has retired.

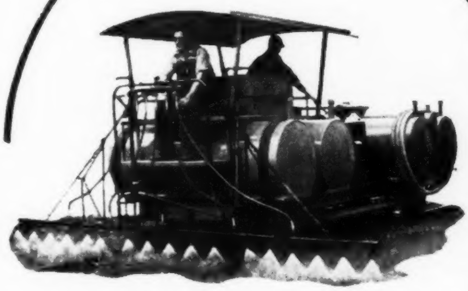
T. T. Tucker has been appointed track supervisor on the Atchison, Topeka & Santa Fe, with headquarters at Marceline, Mo., succeeding **W. W. Scott,** who has retired.

Robert S. Fonda, whose appointment as supervisor of track on the Boston & Albany, with headquarters at Springfield, Mass., was announced in the August issue, was born in Fonda, N. Y., on June 21, 1903. He entered the service of the New York Central on April 19, 1920, as a timekeeper at Fonda and later served as assistant track foreman, extra-gang foreman and work-train foreman at that location. He was promoted to assistant supervisor of track on Sub-division 23, with headquarters in Canandaigua, N. Y., on September 24, 1937, and on September 1 of the following year, he was transferred to Sub-division 8, at Oneida, N. Y., the position he held at the time of his recent appointment.

George W. Sturgeon, whose promotion to supervisor of track on the Wilkes-Barre division of the Pennsylvania, with headquarters at Sunbury, Pa., was announced in the August issue, was born in Goldsboro, Pa., on June 10, 1913. He entered railway service on May 13, 1937, as a trackman on the Philadelphia division of the Pennsylvania and later served as camp inspector, assistant foreman and foreman-track. On February 1, 1945, he was promoted to general foreman with headquarters at Enola, Pa., and on June 1 of that year was promoted to assistant supervisor with the same headquarters. Mr. Sturgeon was transferred to New Brunswick, N. J., on the New York division on January 16, 1947, and was holding that position at the time of his recent promotion.

(Please turn to page 1202)

Cut your *Maintenance* costs!



Woolery Combination Chemical Sprayer and Weed Burner. One machine now serves a dual purpose. Showing machine spraying an 18' wide swath.

Woolery Tie Cutter with Undercarriage permits two cuts on one tie without lifting machine and turning it around. Speeds tie cutting operation.

Woolery Combination Chemical Sprayer and Weed Burner showing machine used as a weed burner. Burns a swath 15' wide.

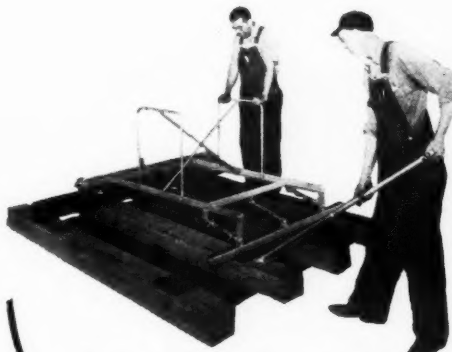
...use WOOLERY equipment

Operating modern trains on fast schedules requires modern track maintenance. And for modern track maintenance at low cost over 75 railroads now use all types of Woolery Maintenance Equipment.

The result of 23 years of experience, Woolery Equipment is designed and built to do the job faster, better, and safer. All costly time consuming methods for keeping track and roadway maintained are eliminated. With Woolery Equipment you can stretch your maintenance budget by saving time and increasing efficiency.

Now by popular demand Woolery has added three new items to its famous line of railway maintenance equipment.

1. **Woolery Flangeway Cleaner**
2. **Woolery Joint Oiler**
3. **Woolery Combination Chemical Sprayer and Weed Burner**



Woolery Tie Plate Spacer speeds up rail laying by quickly locating tie plates at the proper distance from other rail.

WRITE TODAY FOR BULLETINS

New bulletins have just been printed, illustrating and describing in detail these new units and other Woolery equipment. If you do not have them in your files, write for them today. You will be pleased with the time and money savings you make using Woolery equipment.

WOOLERY MACHINE COMPANY

MINNEAPOLIS Pioneer Manufacturers of **MINNESOTA**

RAILWAY MAINTENANCE EQUIPMENT

RAILWAY WEED BURNERS • MOTOR CARS • TIE CUTTERS • TIE SCORING MACHINES • RAIL JOINT OILERS • CREOSOTE SPRAYERS • BOLT TIGHTENERS

EXCLUSIVE EXPORT REPRESENTATIVES: PRESSED STEEL CAR COMPANY, INC., PITTSBURGH, PENNA.

Railway Personnel (Cont'd)

H. S. Chandler, general track inspector on the Chesapeake district of the Chesapeake & Ohio, has been promoted to general supervisor of track, with headquarters as before at Richmond, Va., and **W. P. Nichols,** general track inspector at Huntington, W. Va., has been appointed general supervisor of track, with the same headquarters. **P. W. Shenefield,** assistant supervisor of track at Marion, Ohio, has been advanced to supervisor of track on the Columbus Terminal district, with headquarters at Columbus, Ohio, succeeding **P. R. Matthews**, whose appointment as assistant division engineer is noted elsewhere in these columns.

J. J. Baffa, whose promotion to supervisor of track of the Erie and Ashtabula division of the Pennsylvania, with headquarters at New Castle, Pa., was announced in the August issue, was born in New York on March 8, 1917. He attended the University of Cincinnati, graduating in 1941 and on June 16 of that year he entered the service of the Pennsylvania as an assistant on the engineering corps at Columbus, Ohio. From November, 1941, until August, 1946, he served in the navy as a transportation officer, being discharged with the rank of lieutenant-commander. Mr. Baffa then returned to his former position at Columbus and in January, 1947, was promoted to assistant supervisor of track on the New York division, with headquarters at Jamesburg, N. J. In June, of 1947, he was transferred to the Middle division, at Lewistown, Pa., where he was located at the time of his recent promotion.

Robert R. McClain, whose promotion to supervisor of track on the Delmarva division of the Pennsylvania, with headquarters at Harrington, Del., was announced in the August issue, was born at Coshocton, Ohio, on April 8, 1919. He attended Ohio State University and entered the service of the Pennsylvania on April 1, 1942, as engineer apprentice at Terre Haute, Ind., being transferred to Columbus, Ohio, on August 27 of that year. He served in the navy between December 16, 1942, and April 1, 1946, and on the latter date returned to the Pennsylvania as assistant on the engineer corps, with headquarters at Chicago. Mr. McClain was promoted to assistant supervisor of track at Columbus, Ohio, in August, 1947, and on March 1, 1948, was transferred to Huntingdon, Pa., where he remained until his recent promotion.

Bridge and Building

Frank Duresky, Jr., whose appointment as supervisor of bridges and buildings on the Chicago & North Western, with headquarters at Huron, S.D., was noted in the September issue, was born on March 30, 1900, at Winona, Minn. He entered the service of the North Western in 1917, and in October, 1922, was appointed bridge carpenter. From October, 1927, to August, 1929, he served as division scale inspector at Madison, Wis., subsequently serving as painter foreman and mason foreman until February, 1942, when he was promoted to assistant supervisor of bridges and buildings at Huron. In October, 1943, Mr. Duresky was transferred to Milwaukee, Wis., where he was stationed at the time of his recent promotion to supervisor of bridges and buildings.

Special

M. Turnbull, architect of the Central Railroad of New Jersey, with headquarters at Jersey City, N. J., retired on October 1.

C. J. Brightwell has been appointed supervisor of work equipment on the Huntington division of the Chesapeake & Ohio, with headquarters at Huntington, W. Va.

Obituary

John H. Moore, retired roadmaster on the Atlantic Coast Line, died on August 16, at Rocky Mount, N. C.

Clark Dillenbeck, who retired in July, 1938, as chief engineer of the Reading at Philadelphia, Pa., died on October 9 at his home in Plainfield, N. J. He was 82 years old.

Alfred A. Visintainer, engineer of structures of the Erie, with headquarters at Cleveland, Ohio, died on September 27 at Hornell, N. Y., following a heart attack while on an inspection tour. Mr. Visintainer was born at Mount Carmel, Pa., on October 11, 1903, and was graduated in civil engineering from Lehigh university in 1926, immediately following which he entered railway service in the engineering department of the Erie on construction work at Youngstown, Ohio. On July 1, 1929, he was advanced to inspector, and on January 1, 1939, he was promoted to construction inspector, advancing to assistant engineer in the department of structures on February 1, 1943. Mr. Visintainer became assistant engineer of structures in December, 1944, and was appointed engineer of structures in May, 1947.

Alfred A. Visintainer

Association News

American Railway Engineering Association

The Nominating committee will meet at Chicago on November 16 to select a slate of officers to be voted on in the election next year. This will be the first time that the Nominating committee will function under the constitutional amendment providing for the election of four directors instead of three. The Board of Directors will also meet on November 16 to receive the report of the Nominating committee and to hear a report on the progress that has been made in developing plans for the semi-centennial convention to be held next March.

The Board of Direction Committee on Personnel met at Chicago on October 25 to consider all recommendations and requests that had been received relative to changes in the personnel of standing committees. Because of the large influx of new members this year, it is expected that the number of members serving on committees will increase to an all-time high record.

A number of committees have scheduled meetings to be held in November. The Committee on Iron and Steel Structures will meet at Lafayette, Ind., on November 3 and 4; the Committee on Wood Preservation will meet at 466 Lexington avenue, New York, on November 10; the Committee on Records and Accounts will meet at the Mayflower Hotel, Washington, D.C., on November 17 and

(*Continued on page* 1204)

Meetings and Conventions

American Railway Bridge and Building Association—Annual meeting, September 13-15, 1949, Hotel Stevens, Chicago. Elise LaChance, Secretary, 431 S. Dearborn street, Chicago 5.

American Railway Engineering Association—Annual Meeting, March 15-17, 1949, Chicago, W. S. Lacher, secretary, 59 E. Van Buren street, Chicago 5.

American Wood-Preservers' Association—Annual Convention April 26-28, 1949, St. Louis, Mo. H. L. Dawson, secretary-treasurer, 1429 Eye street, N.W., Washington 5, D.C.

Bridge and Building Supply Men's Association—E. C. Gunther, secretary, 122 S. Michigan avenue, Chicago 3.

Maintenance of Way Club of Chicago—Next meeting, November 22, 1948. E. C. Patterson, secretary-treasurer, Room 1512, 400 W. Madison St., Chicago 6.

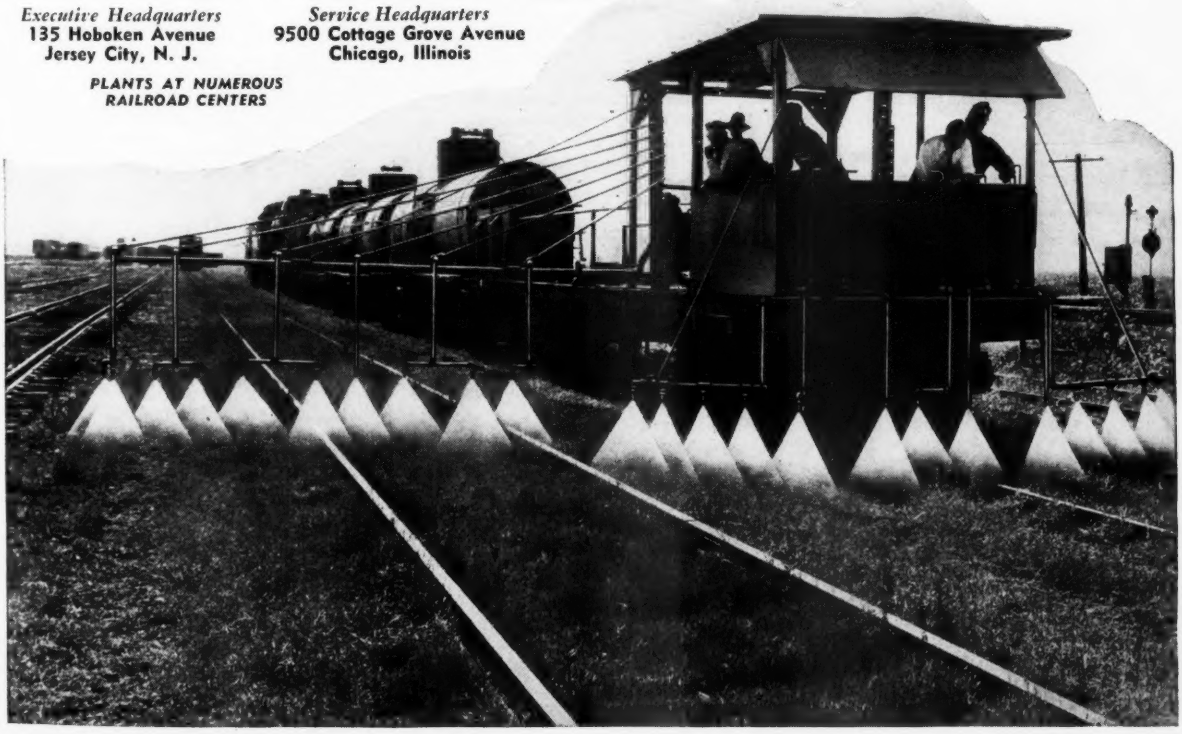
Metropolitan Maintenance of Way Club—John S. Vreeland, secretary, 30 Church street, New York.

National Railway Appliance Association—Annual exhibit, Chicago, March 14-17, 1949, in connection with the A.R.E.A. convention. R. B. Fisher, secretary, 1 No. LaSalle street, Chicago 4.

Railway Tie Association—Annual convention, September 12-14, 1949, Peabody Hotel, Memphis, Tenn. Roy M. Edmonds, secretary-treasurer, 610 Shell Building, St. Louis 3, Mo.

Roadmasters' and Maintenance of Way Association of America—Annual meeting, September 13-15, 1949, Hotel Stevens, Chicago. Elise LaChance, secretary, 431 S. Dearborn street, Chicago 5.

Track Supply Association — Lewis Thomas, secretary, 59 E. Van Buren street, Chicago 5.



Association News (Cont'd)

18; and the Committee on Rail will meet at 466 Lexington avenue, New York, on November 19.

Bulletin No. 475 (September-November) is now in the hands of members. This bulletin is devoted largely to an advance report of the Committee on Impact and Bridge Stresses, which contains reports on eight separate tests.

Railway Tie Association

The next annual convention of the association will be held at the Peabody Hotel, Memphis, Tenn., September 12-14, 1949.

Roadmasters' Association

Cards have gone out to all members asking their preference for committee work during the ensuing year, with the request that these cards be returned to the secretary by November 1. The Executive committee will meet in Chicago on November 8 to select the committee personnel on the basis of the expressed member preferences.

Bridge and Building Association

President E. H. Barnhart has called a meeting of the Executive committee in Chicago on November 8 to select the personnel for the technical committees for the ensuing year. Assignment to committees will be made on the basis of preferences expressed by members on a duplex card which has been mailed to members, with the request that replies be in the hands of the secretary by November 15 at the latest.

Maintenance of Way Club of Chicago

With 120 persons in attendance the first fall meeting of the club was held on October 25, when H. R. Duncan, superintendent timber preservation, Chicago, Burlington & Quincy, spoke on Prolonging the Life of Crossties. The meeting was held at a new location—Eitel's Restaurant in the Field Building, Clark and Adams streets.

The next meeting of the club will be held on November 22, beginning, as usual, with a dinner at 6:30 p.m. The speaker at this meeting will be announced later.

Wood Preservers' Association

According to President G. B. McGough, general superintendent of Bond Bros., Inc., the association, during the last three years, has enjoyed the greatest gain in membership in its 44-year history—a gain of over 37 per cent since October 1, 1945. A total of 163 new members have joined during the 12-month period ended October

(*Continued on page* 1206)

Association News (Cont'd)

1. It has also been announced that honorary memberships in the association have been extended to Frank D. Mattos, manager, treating plants, Southern Pacific Company, West Oakland, Cal., and R. S. Belcher, manager, treating plants, Santa Fe System, Topeka, Kans. The next annual meeting of the association will be held at St. Louis, Mo., April 26-28, 1949.

Supply Trade News

General

The **Thew Shovel Company** has announced completion of extensive expansion at its parts division in Elyria, Ohio, including additions to its plants Nos. 3 and 5.

The **Pettibone Mulliken Corporation,** Chicago, has announced the purchase of the **Universal Engineering Corporation** of Cedar Rapids, Iowa. The latter firm has been a leading manufacturer of crushing, screening, washing and loading equipment for over 42 years.

The **Buda Company,** Harvey, Ill., has acquired **W. F. Hebard & Co.,** Chicago, manufacturers of materials handling equipment. The Hebard Company will be operated as a wholly-owned subsidiary of the Buda Company and will continue to manufacture its present products.

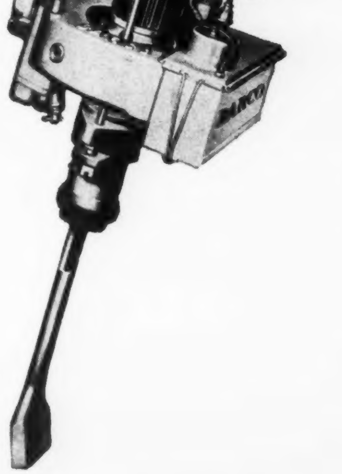
Personal

Robert B. Barnes, assistant sales manager of the **Link-Belt Speeder Corporation,** has been promoted to sales manager, with headquarters at Cedar Rapids, Iowa, succeeding **Hayes Parsons,** who has retired on account of illness. For the past 20 years Mr. Barnes has been identified with the application of power shovels, draglines and cranes in the construction industry.

Robert B. Barnes

(*Please turn to page* 1208)

ROADBEDS STAY IN SHAPE LONGER IF YOU USE BARCO UNIT TYTAMPERS



Ballast under a Barco-tamped tie is firmly and uniformly packed for the full width of the tie and is less subject to further compression from passing trains. No other spot tamper produces the fast, powerful blows of the Barco. Self-contained and portable, these economical sluggers save extra time at congested points because they tamp faster and can be moved off the right-of-way quickly. Over 100 railroads use Barco for spot or gang tamping. Write today to Barco Manufacturing Company, 1805 Winnemac Avenue, Chicago 40, Ill. In Canada: The Holden Co., Ltd., Montreal, Canada.

BARCO

UNIT TYTAMPERS

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

Supply Trade News (Cont'd)

F. A. Douglass, formerly assistant engineer in the office of engineer of maintenance, Chicago & North Western, at Chicago, has joined the **Woodings-Verona Tool Works,** Peoples Gas Building, Chicago 3, Ill.

William A. Hart has been appointed district manager of the Railroad division of the **Buda Company,** with headquarters at Chicago. Mr. Hart was born in Battle Creek, Mich., on June 18, 1919, and following graduation from Purdue university in 1940 with a Bachelor of Science degree in mechanical engineering, he entered the sales department of the Buda Company at Harvey, Ill. In 1941 he went to New York to represent the Railroad division in export and industrial sales. The following year he was granted a leave of absence to join the U. S. Army Air Force as a cadet in engineering, being commissioned a major in October, 1944. Mr. Hart rejoined the Buda Company in November, 1945, at New York, and a year later he was appointed representative for the Railroad and Industrial divisions in the Minneapolis-St. Paul territory, the position he was holding at the time of his recent promotion.

William A. Hart

The **National Aluminate Corporation,** Chicago, has announced the following changes in titles of personnel: **V. E. McCoy,** chief engineer, to manager, railroad weed control; and **C. A. Brown,** railroad service, to mechanical engineer, railroad department.

B. F. Bilsland has been promoted from manager of the Chicago district of the **Allis-Chalmers Manufacturing Company** to manager of the newly-formed Midwest region, with headquarters as before at Chicago. **J. C. Collier** will succeed Mr. Bilsland as Chicago district manager.

Gerald W. Wilson and **William F. Jordan** have been appointed district representatives in the Eastern sales division of the **Caterpillar Tractor Company.** Mr. Wilson will represent the company in northern Georgia, South Carolina and eastern Tennessee, and Mr. Jordan will be its representative in northern Ohio, Michigan and West Virginia.

(*Please turn to page* 1210)

Supply Trade News (Cont'd)

Harry A. Wolfe, who recently resigned as Chicago district manager of **The Buda Company,** has rejoined the sales organization of **The Lehon Company,** as division sales manager, railway department, with headquarters at Chicago. **Clarence E. Croisant,** sales supervisor, railway department, and **A. C. Senseney,** sales engineer, railway department, have both been appointed division sales managers, railway department, with headquarters at Chicago.

Mr. Wolfe was born in 1897 and attended Valparaiso University. In 1916 he went with the Chicago, Milwaukee, St. Paul & Pacific as a clerk in the accounting department, and in 1918 he resigned to enter the armed forces of the United States, serving with the 96th division. In 1919 Mr. Wolfe returned to the Milwaukee as chief clerk to the superintendent of motive power, and in 1922 he was promoted to supervisor of fuel. In 1926 he went with the Lehon organization as a special representative, and 14 years later he was advanced to supervisor of railroad sales. In 1944 Mr. Wolfe left the Lehon Company to become field representative of the Buda Company, subsequently being promoted to district manager with headquarters at Chicago.

Harry A. Wolfe

Obituary

Karl O. Schreiber, vice-president in charge of manufacturing of the International Harvester Company at Chicago, died on October 5 in Evanston hospital, Evanston, Ill.

Trade Publications

(To obtain copies of any of the publications mentioned in this column, use postcards, page 1127)

Direct Warm Air Heaters—The Lee Engineering Company has released an eight-page, illustrated bulletin dealing with its direct warm air heating system for industrial buildings. Printed in two colors, the pamphlet contains illustrations and specifications on the various types of heaters available.

Industrial Asphalt Flooring Emulsions—The Flintkote Company has issued an eight-page, illustrated pamphlet describing its flooring emulsions for industrial mastic floors. The bulletin, which is printed in two colors, gives detailed information on both hand-finished and power-floated applications.

Welding Products—The American Manganese Steel Division of the American Brake Shoe Company has released a 16-page, illustrated catalog containing price information on its hard-facing, build-up rods, electrodes and weldments.

Crawler-Mounted Shovel-Crane—The Link-Belt Speeder Corporation has released Book No. 2259 covering its crawler-mounted shovel crane models K-360 and K-365, equipped with Speed-O-Matic hydraulic controls. In addition to giving specifications, clearances and working ranges, the bulletin contains a number of application photographs.

Hardfacing Alloys—A 16-page, illustrated booklet describing its complete line of hardfacing alloys has recently been published by the Air Reduction Sales Company. Included in the catalog are data on typical uses, specifications, application technique, deposit hardness, color markings and deposit analysis. It also contains information on how to combat wear and increase equipment work-life.

Rust Preventives—The Rust-Oleum Corporation has published a 16-page booklet outlining the qualities of its rust preventive products for industrial, railroad, marine and general use. The catalog gives directions for the use and application of Rust-Oleum. It also contains 48 color cards showing the various colors in which Rust-Oleum is obtainable, and 22 color panels of machinery and implement finishes. The concluding section of the bulletin outlines recommendations for the use of Rust-Oleum on building materials requiring a liquid sealer as a waterproofing agent.

Aluminum Alloys and Mill Products Data Book—This is the title of a 166-page, pocket-size book issued by the Reynolds Metals Company. Included in the book are 163 tables containing data on alloys, tempers, sizes, shapes, physical properties, fabricating characteristics, etc., plus 33 pages of explanatory text covering a wide range of related subjects, such as the alloy designation system, heat-treatable and non-heat-treatable alloys, foundry practice, etc. Tables are arranged in groups for ready reference.

There's a better way: use WHITE Switch Heaters

Gangs of men are not needed to keep switches open when WHITE Gas Burning Switch Heaters are used. For 25 years they have proven to be the only snow melters which can effectively cope with maximum storms. There are no clogged switches with WHITE heaters.

Write for descriptive circulars.

White
Manufacturing Company
ELKHART, INDIANA

E. R. Mason, New York; Reade Mfg. Co., Chicago

UNIT CRANES *"Tailor-made" for Railroad Jobs*

Milwaukee Road Work Train

Something unusual in construction is this flat car crawler crane carrier. It consists of guide angles laid lengthwise along top of car to form a runway for the crawlers. Machine can travel full length of car without danger of running off. The car is divided into three sections which act as operating positions as the work progresses. Crossbeam dividers can be inserted as stabilizers while the machine is in operation, or when the entire train is moving.

Mobile UNITS for Yard Work

UNIT 357 Mobile Crane is self-propelled ... Rides on rubber ... Ready for action with a push on the starter ... Travels anywhere ... gets there in a hurry. Fully convertible to all attachments ... Operated by ONE man ... Powered by ONE engine ... Controlled from ONE position in UNIT's safety promoting FULL VISION CAB.

½ and ¾ Yd. Excavators

5 and 10 ton Cranes

CONTACT FACTORY DIRECT
for Price and Delivery
or See Your Dealer

UNIT CRANE & SHOVEL CORP.

6403 WEST BURNHAM STREET
MILWAUKEE 14, WIS., U.S.A.

RACINE *Portable* RAIL SAWS

For any Rail Cutting Job

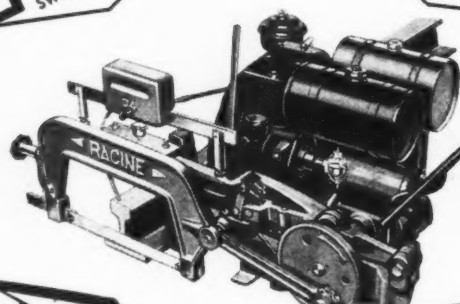
IN TRACK OR SHOP

Today's users of RACINE portable RAIL SAWS are continually enjoying the many economies made possible by RACINE'S faster and more accurate method of rail cutting. Here is a one-man tool that substantially reduces time and costs per cut. 100 lb. rail can be cut in an average of 5 minutes. 130 lb. rail in 7 minutes.

FOR CUTTING AND FITTING RAILS AT INTERLOCKING PLANTS, CROSSINGS AND SWITCHES.

FOR CLOSING OF TRACK IN RAIL LAYING OPERATIONS

FOR ACCURATE AND FAST CUTTING OF RAILS FOR INSULATED JOINTS



FOR PROPER STAGGERING OF JOINTS AND CURVES

FOR REMOVING SPLIT OR BATTERED RAIL ENDS

FOR CUTTING OUT PORTIONS OF WHEEL-BURNED RAILS

Racine Rail Saws are truly portable. They can be easily transported by two men. Only one man needed to operate. Saw blades are of special alloy steel developed to assure maximum speed and cutting economy. Cuts as thin as 3/10 of an inch can be made quickly and accurately. Models are available with gasoline, electric or compressed air motors. Write today for complete Catalog. Address Racine Tool & Machine Co., 1738 State St., Racine, Wisc.

STANDARD FOR QUALITY AND PRECISION · RACINE · RACINE TOOL and MACHINE CO.

RACINE

STANDARD FOR QUALITY AND PRECISION

WARWOOD WORKMANSHIP MAKES THE DIFFERENCE

WARWOOD TRACK TOOLS

Claw Bar

No. 11-T

A tough track job requires toughness in tools ...and that's just where the Warwood Claw Bar comes in. Accurately forged, correctly designed and scientifically heat treated to meet A. R. E. A. specifications...it is made for a tough job. Whatever the job in track maintenance and repair work . . . there's a Warwood Track Tool especially made for it. Specify and buy Warwood Track Tools.

PICKS... MAULS... WRENCHES BARS.. TONGS.. SLEDGES.. ADZES PUNCHES... CHISELS

WARWOOD SINCE 1854 FORGED TOOLS

WARWOOD TOOL COMPANY

WHEELING, WEST VIRGINIA

Barber-Greene

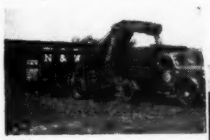
Mechanize Now!

WITH THE ONE-MAN MACHINE THAT DOES

all 3...

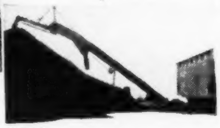
847167

1 Car unloading



445448

2 Stockpiling



A-693-8

3 Loading — screening

846434

Save

MANPOWER, INVESTMENT, DEPRECIATION WITH THE B-G 661

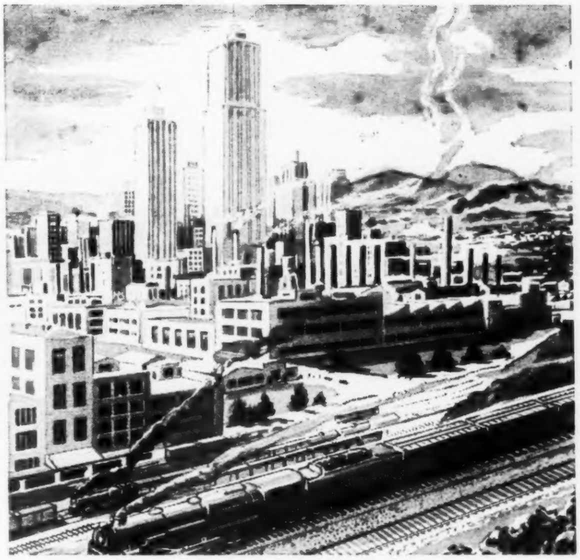
The B-G 661 Gooseneck makes it possible to mechanize all coal unloading, stockpiling and loading operations—to speed up and effectively cut the cost of all three. This self-propelled machine combines Truck Loader with power driven Car Unloader and Stacker to enable one man to handle all basic coal-moving work around the yard or plant. To learn more about the savings a 661 Gooseneck can mean to you fill in and send for new literature. Address Barber-Greene Co., Aurora, Ill.

With a 661 Gooseneck and Unloader-Stacker attachments, you can:

- *Unload all sizes of coal from car in 90 minutes*
- *Load trucks at 1½ tons per minute*
- *Screen coal with vibrating screen*
- *Stockpile to elevation of 20 ft.*
- *Load largest trucks, regardless of sideboards*
- *Move equipment under its own power*

BARBER-GREENE COMPANY, AURORA, ILLINOIS

Constant flow Equipment



Higher Production
LOWER OPERATING COST

TWO outstanding features of Layne Well Water Systems are—Higher Production and Lower Operating Cost. These advantages are the result of excellence in engineering design, plus the proper methods of installation. Such features are of utmost importance in all situations where ground water is used in large quantities: cities, factories, chemical plants, railroads, packing houses, steel mills, refineries, etc.

But Layne is not satisfied to offer higher production and lower operating cost alone. There is the matter of dependable quality and substantial construction. Not once in nearly seventy years of Layne operation has quality been lowered. Today, your Layne Well Water System is better than ever before; tougher where wear is heaviest, more rugged where strength is needed and finer machined for accuracy and smoother operation.

For the best that skill and care can create, plus top flight and proved efficiency at low operation cost, insist on a Layne Well Water System.

For further information, catalogs, bulletins, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

LAYNE
WELL WATER SYSTEMS

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Washington ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Minnesota Co., Minneapolis, Minnesota ★ International Water Corporation, Pittsburgh, Pa. ★ International Water Supply, Ltd., London, Ontario, Canada ★ Layne-Hispano Americana, S. A., Mexico, D. F.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946

Of Railway Engineering and Maintenance published monthly at Chicago, Ill., for October 1, 1948.

State of Illinois }
County of Cook } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared S. W. Hickey, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Railway Engineering and Maintenance and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily, weekly, semiweekly or triweekly newspaper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Simmons-Boardman Publishing Corp., 30 Church St., New York 7, N. Y.; Editor, Neal D. Howard, 105 W. Adams St., Chicago 3, Ill.; Managing Editor, Merwin H. Dick, 105 W. Adams St., Chicago 3, Ill.; Business Manager, S. Wayne Hickey, 105 W. Adams St., Chicago 3, Ill.

2. That the owners are: Simmons-Boardman Publishing Corporation, 30 Church Street, New York 7, N. Y.; Stockholders of 1 per cent or more of the total amount of stock are: Mrs. I. R. Simmons, Pelham Manor, N. Y.; S. O. Dunn, 105 West Adams St., Chicago, Ill.; Mrs. C. E. Dunn, 3500 Sheridan Blvd., Chicago, Ill.; Mrs. Mae E. Howson, 6922 Paxton Ave., Chicago, Ill.; Ella L. Mills or Catherin S. Mills, Westfield, N. J.; Mrs. E. G. Wright, 398 No. Walnut St., East Orange, N. J.; Mrs. E. H. Thompson, East Cleveland, Ohio; Mrs. Maude E. Slate, Summit, N. J.; Mrs. M. J. Blechner, Woodbury, Conn.; Henry Lee, Hopatcong, N. J.; Mrs. Pearl A. Lee, Hopatcong, N. J.; Ingalls & Snyder, 100 Broadway, New York, N. Y.; General Partners of Ingalls & Snyder are: Roscoe C. Ingalls; John T. Snyder; Warner W. Kent; Daniel L. Monroe; Samuel H. Watts; Ralph P. Hinchman, Jr.; Thorvald F. H. Tenney; Chester C. Veldran, all of 100 Broadway, New York, N. Y.; J. Streicher & Co., 2 Rector St., New York, N. Y.; Partners of J. Streicher & Co. are: Joseph Streicher; Jack L. Streicher; Ethel Streicher; Judson L. Streicher, all of 2 Rector Street, New York, N. Y.; Spencer Trask & Co., 25 Broad St., New York, N. Y. General partners of Spencer Trask & Co. are: Edwin M. Bulkley, Ltd., 817 Fifth Ave., New York 21, N. Y.; Estate of Acosta Nichols, Ltd., c/o Arthur H. Gilbert, Exec., 25 Broad St., New York 4, N. Y.; Cecil Barret, Ltd., Bar Harbor, Maine; C. Everett Bacon, c/o Gerald C. Holbrook, High Tide, Hobe Sound, Fla.; F. Malbone Blodget, 65 Patterson Ave., Greenwich, Conn.; Arthur H. Gilbert, 440 Park Ave., New York 22, N. Y.; Henry S. Allen, 407 Highland Ave., Orange, N. J.; William Kurt Beckers, 1115—5th Ave., New York 28, N. Y.; Edwin M. Bulkley, Jr., 18 West Trail Tokeneke, Darien, Conn.; Charles F. Bryan, 83 Adams St., Garden City, L.I., N.Y.; Harold H. Cook, 259 So. Mountain Ave., Montclair, N. J.; Brittin C. Eustis, Old Chester Road, Essex Fells, N. J.; Anton Henry Rice, Jr., 1 Riverview Rd., Irvington-on-Hudson, N. Y.; R. Inslee Clark, 87—10th St., Garden City, L.I., N.Y.; Hartwell H. Bellows, 1 Ascan Ave., Forest Hills, N. Y.; Allan Chotard Eustis, Jr., Hulda Hill Road, Wilton, Conn.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

S. W. HICKEY, Business Manager.

Sworn to and subscribed before me this 23rd day of September, 1948.
[SEAL] EDMUND J. PUYDAK, Notary Public.
(My commission expires March 30, 1949.)

ALPHABETICAL INDEX TO ADVERTISERS, NOVEMBER, 1948

 For additional information, use postcard, pages 1127-1128


THE
UNIT
RAIL ANCHOR
More RUGGED in every respec
UNIT RAIL ANCHOR COMPANY, IN
6301 BUTLER STREET
PITTSBURGH 1, PENNSYLVAN

A typical Blue Brute Track Team owned by the Detroit, Toledo & Ironton R. R., surfacing track north of Lima, Ohio

BLUE BRUTES SMOOTH UP THE LINE... BETTER AND FASTER... FOR THE D.T.&I.

Here's how Blue Brute Track Teams cut the time and cost of maintenance for one of the country's heaviest-hauling railroads.

The Detroit, Toledo & Ironton has found that the tough, power-packed Blue Brute Railroad Hand-I-Air Compressor . . . though easily transported by two men . . . delivers an *unfailing* supply of air for four WTT-7 Blue Brute Tie Tampers . . . 60 cubic feet per minute through its light, tight, easy-breathing Feather* Valves.

D. T. & I. men also know that the 42-lb. WTT-7's are easy on the operator and precision-balanced for smooth, trouble-free action . . . while improvements like the leak-proof throttle and anti-freeze design assure peak performance under all conditions.

Blue Brutes like these are doing faster, better surfacing for railroads all over the country — and cutting costs every foot of the way. Why not investigate how they — and their many other Blue Brute team-mates — can save time and money in your own maintenance work?

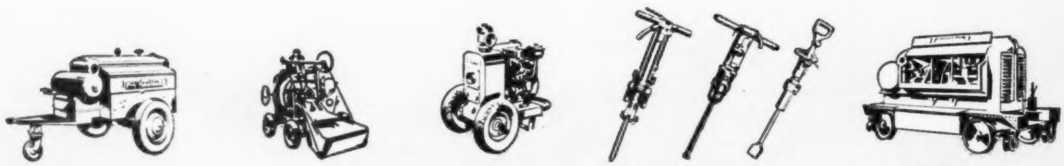
*Reg. U. S. Pat. Off.

H8-6

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Massachusetts
Distributors in All Principal Cities

WORTHINGTON

BUY BLUE BRUTES



60' Portable Compressor | Portable Concrete Mixer | Self Priming Centrifugal Pump | Hand Held Air Tools, | Railcar Compressor

FOR EVERY CONSTRUCTION AND MAINTENANCE JOB